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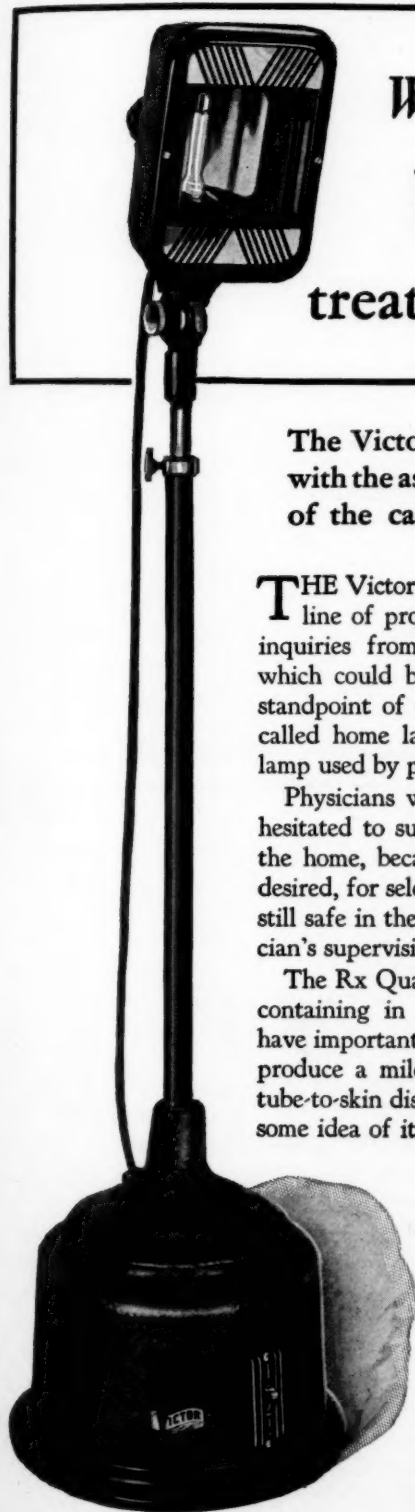
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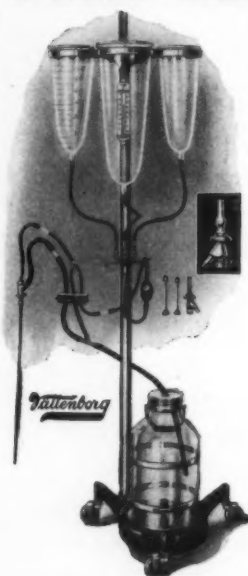
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SUNLIGHT, NUTRITION, AND METABOLISM

I. Calcium Absorption and Assimilation *

VICTOR E. LEVINE, M.D., Ph.D.

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Sunlight has ever exerted a profound influence on mankind. To the race in childhood the sun was a god. The same instinct which led ancient people to worship the sun as a god led them also to a belief in the therapeutic value of sunlight. Since the earliest times men have recognized the value of sunlight in the prevention and treatment of disease. The ancient Egyptians recognized sunlight as a healing agent. On the island of Cos in the Greek Archipelago, where Hypocrates, the father of medicine practiced, the citizens erected a health temple dedicated to Aesculapius, god of sun, medicine and music. The colossal statue at Rhodes was a monument to the sun-god, Helios. The Romans built sun parlors without windows. Coelius Aureleanus, a Roman physician, advised the use of sun baths in chronic affections. To Pliny has been attributed the statement, "Sol est remediorum maximum."

The first modern institute for the scientific treatment of disease by means of light was established by Niels Finsen in Copenhagen. For years his work remained unnoticed and unappreciated. After the publication of his book, "Chemische Lichtstrahlen in der Medizin," physicians gradually turned their attention to his methods. Finsen demonstrated beyond doubt that lupus vulgaris tuberculosis of the skin, can be cured by the action of ultraviolet rays on the affected parts. When Finsen died in 1904 his work had become sufficiently recognized to induce the Danish government to establish the Finsen Medical Light Institute. Another personality that looms large in the development of light treatment is Dr. A. Rollier. In 1904 he established an institute for treatment of sunlight. It is situated in Leyseren in the Ormonts Valley, in the Swiss Alps. His famous sun baths have proved beneficial to sufferers from chronic ulcers, from anemia, from rickets and from several forms of tu-

berculosis of the skin, bones, joints and glands.

Sunlight and Mineral Metabolism

Although ultraviolet or sunlight has been used for a long while as a therapeutic agent, no definite knowledge of its action on the biologic organism was available. With progress in science, empiricism finally gives way to knowledge based on experimental evidence. Such evidence has recently been brought forth leading to a scientific explanation of at least some of the effects of ultraviolet rays on the biologic organism. The most definite facts we have ascertained concern the relation of the ultraviolet rays of the sun to mineral metabolism. At the present state of our knowledge, we know of no specific action of ultraviolet on the physiological process of man except the calcium-absorbing influence through the gastro-intestinal tract and the calcifying influence on ossifying cartilage of a circumscribed band of rays.

Racynski in 1912 gave the first proof of the favorable influence of light on calcium metabolism by his experiments on two puppies. One was reared in the dark, the other in the sunlight. Both suckled the mother. At the end of six weeks the experiment was ended. On analysis the body of the one living in darkness yielded very much less calcium and phosphorus than the one brought up in sunlight.

The decrease in the calcium and in the phosphorus in the body is the result of failure of their deposition in from the osseous system. The significant characteristic of rachitic bone is the relative increase in water, the decrease in total ash, the decrease in calcium and in phosphorus and the increase in magnesium. According to Aschenheim and Kauheimer, a decrease in the calcium of muscle occurs in cases of severe rickets. Anti-rachitic measures cause retention of calcium and of phosphorus. McCollum and his associates have demonstrated increased deposition of calcium and phosphorus in growing rachitic bones as a

* Editorial note — This is the first of a series of three articles by Dr. Levine. The second will appear in the May issue.

result of irradiation. Steenbock and Hart, and Hart, Steenbock and Hoppert have found in goats and in rachitic infants that cod liver oil has the same tendency to retain calcium as light has.

Sunlight and Ultraviolet in Rickets

Sunlight and ultraviolet have received much attention from the standpoint of the cure and prevention of rickets. Huldschinsky, in 1911, reported that ultraviolet rays exerted a curative action on this disease. Sachs, in 1920-21, and Huldschinsky, in 1920, have also reported the cure of infantile tetany with treatment by light. It is to be remembered that this disease is due to a deficiency in calcium ions in the blood, and that it is often a complication found in rickets. Hess and Unger, in 1921, were the first to demonstrate by means of roentgenological studies that sunlight alone possesses the same curative action in human rickets as the light of the quartz mercury vapor lamp. Hess and his co-workers also reported in the same year the prevention of rickets in rats by exposure to sunlight.

Sunlight and Leg Weakness in Chickens

Sunlight also has a great influence on calcium metabolism in chickens. Absence of sunlight produces leg weakness, a condition akin to rickets in the animal and in the human being. Hughes and Payne, and Hart and his co-workers, proved that egg production was greatly influenced by ultraviolet. Hughes and Payne observed that by exposing pullets 10 minutes per day, egg laying was greatly increased in quantity. During the sixteen weeks in which the experiment continued 12 irradiated hens laid 497 eggs as compared to 124 eggs laid by the controls. The eggs from the irradiated hens contained 30 per cent more calcium in the shell and 5 per cent more calcium in the egg itself. The average hatch of eggs from the treated hens was 7.6 per cent against 40 per cent for the controls. The controls began to suffer from leg weakness and from retention of eggs. Several of them died. After a rest period of 19 days the irradiated hens were kept away from ultraviolet while the original control group was now irradiated. As a result of this procedure, the original un-irradiated control group laid more eggs than the hens that were exposed in the first experiment. Hughes and

his co-workers also showed that eggs were deficient in vitamin D when the hen was kept on feed low in vitamin D. Eggs low in vitamin D did not hatch as well as those rich in this dietary factor.

Vitamin D, Sunlight and Ultraviolet Identical Factors in Nutrition

Vitamin D and sunlight or ultraviolet rays seem to be identical factors in nutrition. Goldblatt and Soames, in 1913, placed two litters of rats on diets containing optimum amounts of calcium, phosphorus and cod liver oil. Half of each litter was kept in the dark, the other half of each litter in daylight. Both the daylight rats and the rats kept in darkness showed no signs of rickets or a difference in the calcium content of the bones. In this connection it may be of interest to report the findings of Supplee and Dow, who maintain that summer-produced dry milk has greater anti-rachitic and calcifying properties than winter-produced milk. Fairhall has recently shown that normal rats when irradiated with ultraviolet have a somewhat higher calcium content than un-irradiated rats of the same age. Both on a low and on a normal calcium diet, ultraviolet rays induce a somewhat higher degree of calcium utilization.

The independent results of Steenbock and of Hess also indicate that both light and vitamin D may present the same factor in nutrition. Hess irradiated cotton seed oil with the mercury quartz arc lamp at a distance of one foot. The oil acquired anti-rachitic properties. Steenbock exposed many types of foods to ultraviolet and developed in them anti-rachitic properties. Steenbock and his workers could not activate purified proteins, pure carbohydrates, pure fats, or pure salts.

The food constituent responsible for the development of potency on exposure to ultraviolet was finally traced down by Hess and Weinstock to cholesterol. Later on Windaus and Hess discovered that cholesterol when purified lost its power to become anti-rachitic after irradiation. Rosenheim and Webster purified cholesterol by repeated crystallization and subsequent conversion into the dibromide, from which the sterol was recovered by extraction. Cholesterol thus obtained did not show its usual characteristic absorption bands. They came to the conclusion that ergosterol, a sterol first isolated by Tanret in the oil of ergot, was an impurity connected with chole-

terol. We now know that it is ergosterol that becomes active on irradiation, and that ordinary cholesterol assumes marked anti-rachitic potency after irradiation due to the presence of small quantities of ergosterol.

Ergosterol as an Anti-Rachitic Factor

Ergosterol in very minute quantities is capable of preventing and curing rickets. Brown and Shohl have shown that with increased doses of irradiated ergosterol up to a maximum of 0.1 milligram per day, the bone of ash in albino rats becomes heavier and the calcium retention is greater. Irradiated ergosterol seems to be more rapid in its action in so far as calcium absorption is concerned. Backwin, Backwin and Gottschall, in a series of twenty infants treated for infantile tetany, found that the clinical symptoms disappeared promptly and the serum calcium rose to normal in about seven days. With ultraviolet the removal of symptoms was less rapid. Cod liver oil was too slow and therefore inadequate in the treatment of infantile tetany. They maintain that the treatment of choice consists in the administration of 1 gram of calcium chloride every one or two hours together with the administration of 4 milligrams of irradiated ergosterol.

In comparatively large doses irradiated ergosterol is very toxic. Post-mortem findings relate to abundant deposits of calcium in the blood vessels, heart, stomach, lungs, kidneys and muscles. The sclerosis produced in the blood vessels is similar to that produced in feeding excessive amounts of cholesterol. Kreitmair and Moll report that daily doses of 20 milligrams of ergosterol produced in six days death to white mice. Daily doses of 1 milligram prove fatal in 20 days. Rabbits, cats and dogs succumb on daily doses of 5 milligrams per kilo. We must not forget in holding in mind the toxicity of ergosterol that the minimal doses in which fatality results is one thousand times larger than the amounts necessary to cure or prevent rickets.

Calcium Absorption and Anti-Rachitic or Anti-Tetanic Measures

With reference to rickets and to infantile tetany, we now know that anti-rachitic and anti-tetanic measures affect the absorption of calcium and of phosphorus. This fact has been demonstrated experimentally by a number of investigators—by Schabad, Lesné, Tur-

pin and Zizine, Henderson and Mitchell, Johnson, Orr, Holt, Wilkins and Boone, Telfer, Yoder and others. Guthmann and Schol made studies on forty-eight pregnant women before and after ultraviolet irradiation and noted that instead of the decrease in the calcium content of the blood that is usually observed, the calcium content increased following irradiation. Subtetany and osteomalacia were prevented and the severity of eclampsia and nephropathy diminished. The authors recommend ultraviolet exposure as a routine procedure in case of pregnancy. Ultraviolet irradiation increases the calcium content of the blood and diminishes the calcium losses from the large intestine. Courtney, Tisdall and Brown have shown that the total calcium content of the cecum of rats fed a rachitogenic diet was much higher than that of rats fed the same diet but exposed to sunshine. According to Lesné and his co-workers, and to Reed and Tweedy, ultraviolet does not increase the calcium content of the blood containing normal amounts of this element.

Calcium and Phosphorus Retention With Relation to Anti-Rachitic Measures

That cod liver oil exerts a specific effect on phosphorus and calcium metabolism was first observed by Schabad in his classic studies made in 1909 and 1910. This investigator reported a retention of calcium and phosphorus due to the addition of cod liver oil to the diet of a rachitic infant. On the addition of ordinary oil, however, the balance for both calcium and phosphorus remained negative. In normal subjects calcium elimination is greater in the feces than in the urine. Most of the calcium is lost through the feces. In rachitic subjects still more calcium is lost through the feces than through the urine. In a normal subject there is to be found an excess in the percentage of phosphorus in the urine over that in the feces. In the rachitic subject more phosphorus is lost from the feces than from the urine. On the administration of cod liver oil, one of the striking changes observed is a return of the normal excess in the percentage of phosphorus in the urine over that in the feces.

With reference to irradiated ergosterol, we may mention the work of Hottinger who reported that the rachitic infant responded with a retention of calcium and a diminished ex-

cretion in the urine and stools. The phosphorus balance also improved, but more slowly. Tetany responded in a way similar to rickets. Daniels and her collaborators have recently shown that irradiated milk and irradiated olive oil definitely increased the retention of calcium and of phosphorus.

In judging the ability of anti-rachitic substances to retain calcium or phosphorus, we must take care to have the proper proportion of these elements in the diet. Rickets can develop on a high calcium-low phosphorus diet or on a low calcium-high phosphorus diet. It is now known that an excess of calcium over phosphorus or an excess of phosphorus over calcium results in an undue loss of one or the other of these elements. Even the very early experiments indicated that the quantity of calcium ingested was a factor in its retention. Schloss, in 1916, in an experiment performed on a breast-fed infant observed that after the calcium balance had been unfavorably influenced by cod liver oil, addition of calcium acetate to the diet rendered positive the calcium as well as the phosphorus balance. In this connection we mention the work of Hart, Tourtellotte and Heyl, who reported that an adult human being subsisting on a diet predominating in acid-forming foods (bread, steak, potatoes, butter, cream, lettuce, bananas and coffee), and extremely poor in calcium (150 milligrams per day) showed no increased retention in calcium or phosphorus as a result of daily irradiation with ultraviolet or of the daily administration of 12 cc. of cod liver oil. On the other hand we must note the harmful

of irradiated ergosterol, calcium and phosphorus retention is decreased in rats subsisting on Steenbock's rachitogenic diet.

Sunlight and Ultraviolet With Relation to Gastro-Intestinal Acidity — Diminished Gastric Acidity in Tetany

Sunlight, ultraviolet and vitamin D hold a very interesting relation to gastro-intestinal acidity and to calcium absorption. The character of the gastric secretion in infantile tetany has been the subject of study on the part of Babbott, Johnston and Haskins. They based their clinical diagnosis of tetany on the history or presence of an inspiratory crow, carpopedal spasms, convulsions, and a positive Chvostek sign and positive Trousseau's sign, and confirmed their conclusion by the electrical reaction of Erb, and in the laboratory, by the low calcium content of the blood. Under the conditions of their test meal, they found that the hydrogen ion concentration of the gastric contents of normal infants of 4 to 12 months could be represented by values for pH varying between 3.9 and 4.6. Infants with tetany, the gastric acidity was lower, since the average pH was 5.3. Keeton has also demonstrated diminished tonus and diminished gastric acidity during parathyroid tetany.

Diminished Gastric Acidity in Rickets

Gastric acidity is diminished in rickets. Abrahamson and Miller studied the hydrogen ion concentration in the gastro-intestinal tract of the albino rat, normal or rachitic. On the rachitic diet of Sherman and Pappenheimer, the pH values for the contents of the gastro-intestinal tract were as follows:

Gastric Contents	Upper Half of Small Intestine	Lower Half of Small Intestine
3.8, 3.8, 3.8, 4.0	6.4, 7.0, 7.1, 7.0	7.6, 7.0, 7.4, 7.0

effect of the administration of an excess of anti-rachitic substance. Kroetz reported calcium reduction following irradiation, but his

On the rachitic diet plus cod liver oil, that is, on an anti-rachitic regime, the pH showed a higher acidity for stomach and intestines.

Gastric Contents	Upper Half of Small Intestine	Lower Half of Small Intestine
3.2, 3.3, 3.0, 4.0	5.4, 5.4, 5.6, 5.7	5.6, 5.4, 5.8, 5.8

diet was inadequate and contained undue proportions of calcium and phosphorus, and his time of exposure may have been prolonged. Watchorn observed that after excessive doses

Grayzel and Miller also obtained the following results on dogs subsisting on an adequate diet and in those living on a rickets-producing diet.

TABLE 4
pH of Gastro-Intestinal Contents of Dogs (Grayzel and Miller)

	Stomach	Upper Level	Duodenum Middle Level	Lower Level	Cecum	Colon
On Normal Diet.....	3.68	5.99	6.27	6.36	6.57	6.48
On Normal Diet Plus Ultraviolet Irradiation	3.38	6.03	6.14	6.30	6.34	7.70
On Rickets-Producing Diet.....	3.71	6.81	6.88	7.05	7.27	7.44
On Rickets-Producing Diet Plus Cod Liver Oil	3.40	5.92	6.02	6.11	6.32	6.52
On Rickets-Producing Diet Plus Ultraviolet Irradiation	3.66	5.99	6.17	6.28	6.32	6.91

Grayzel and Miller observed that on Melanby's diet known to produce rickets in puppies, the reaction of the intestinal contents of dogs tended to be more alkaline. The addition of cod liver oil to the diet or irradiation of the dogs with ultraviolet brought the reaction of the intestinal contents back to normal values. The reaction of the intestinal contents of dogs fed high fat, protein, or carbohydrate diets was practically within the normal range for each level of the alimentary tract. The lowering of gastro-intestinal acidity in rickets and its rise to normal under the influence of vitamin D or ultraviolet rays has been confirmed by Yoder.

arach, in 1926, reported that the administration of cod liver oil to the rachitic rat or the exposure of the animal to ultraviolet rays produced a definite increase in the acidity of the feces. On the other hand it must be said that Shohl and Bing report that the cure of rickets is not necessarily associated with an alteration of the pH of the feces from alkaline to acid. The slight alteration in pH which they obtained with Steenbock's diet as compared with the greater shift with Zucker's diet may be associated with differences in potential alkalinities. The former diet yield for every 100 grams of food 530 c.c. of decinormal alkali, while the latter diet was equiv-

TABLE 5
pH of Feces and Contents of Duodenum, Ileum and Cecum (Yoder)

Ration	Rat No.	Duodenum	Ileum	Cecum	Feces	Mean
Rickets Ration and Cod Liver	1	6.27	6.75	7.48	7.12	6.90
Oil	2	6.66	7.05	7.63	7.43	7.19
Mean		6.46	6.90	7.55	7.27	7.04
Rickets Ration and	3	7.00	7.00	7.86	7.55	7.35
Irradiation	4	8.74	6.71	7.43	7.64	7.13
Mean		6.87	6.85	7.64	7.59	7.24
	5	6.75	6.85	7.64	7.59	7.24
Rickets Ration	6	6.77	6.28	7.97	7.71	7.43
	7	6.66	7.83	7.95	7.98	7.60
Mean		6.72	7.39	8.14	7.90	7.54

Sunlight and Intestinal Acidity

We have just seen that cod liver oil and ultraviolet rays have the ability to increase gastro-intestinal acidity in rats and dogs subsisting on a rickets-producing diet. It remains for us to determine whether sunshine has a similar effect. Tisdall and Price, working with rachitic rats, reported after exposure to sunlight an increase in the acidity of the intestinal tract. Their findings are tabulated below:

The work of Tisdall and Price confirms the work of Abrahamson and Miller, of Grayzel and Miller and also of Yoder. It appears that the intestine of the normal rat becomes progressively more acid throughout its entire course, while the intestine of the rachitic rat becomes progressively more alkaline. Zucker and Matzner, in 1923, and Jephcott and Bach-

alent to only 110 c.c. of decinormal alkali. The feces of the animals receiving Steenbock's ricket-producing diet were alkaline. The feces of groups receiving irradiated food were less alkaline and practically neutral, but not acid. Evidently there is a change in hydrogen ion concentration, but the change is not always great enough to make the feces acid.

Tisdall and Price observed that the acidity of the intestine of the rat on a rickets-producing diet exposed to sunlight daily closely approximated that of the normal animal. Short daily exposures to sunshine produced just as marked changes in the acidity of the intestines as long exposures. The acidity of the intestines of the rats exposed for only five, or ten to fifteen minutes daily proved to be the same as that of the rats

TABLE 6
Hydrogen-Ion Concentration of the Intestinal Contents of Rachitic Rats

Dates (1927)	Upper Half of Small Intestine pH	Lower Half of Small Intestine pH	Cecum pH	Cecum and Colon Mixed pH	Colon pH	Feces pH
June 20	6.5	5.7	-----	6.8	-----	-----
	6.6	6.9	-----	7.1	-----	7.2
July 4	6.5	6.9	-----	7.0	-----	7.6
	6.6	6.6	-----	6.9	-----	7.7
	6.2	6.2	-----	6.6	-----	7.1
	6.3	6.2	6.8	-----	6.8	7.4
	6.4	6.5	6.8	-----	7.1	7.4
	6.7	6.0	6.5	-----	6.6	7.4
Average	6.47	6.57	6.70	6.88	6.83	7.44

Hydrogen-Ion Concentration of the Intestinal Contents of Rats on the Rickets-Producing Diet and Exposed to Sunshine Daily

Date	Duration of Ex- posure	Upper Half of Small Intestine pH	Lower Half of Small Intestine pH	Cecum pH	Cecum and Colon Mixed pH	Colon pH	Feces pH
July 4	5 Min.	6.7	6.6	-----	6.4	-----	7.2
July 11	5	6.5	6.4	6.4	-----	6.4	6.8
July 27	10	6.5	6.7	-----	6.0	-----	-----
		6.7	6.7	-----	6.0	-----	6.6
		6.4	6.4	-----	6.0	-----	-----
July 11	10	6.4	6.4	6.3	-----	6.4	6.8
July 27	15	6.8	6.6	-----	6.0	-----	6.6
June 27	1 Hrs.	6.5	6.5	-----	6.0	-----	-----
		6.5	6.5	-----	6.0	-----	6.4
		6.7	6.6	-----	6.0	-----	-----
June 20	2	7.0	6.6	-----	6.4	-----	-----
		6.2	6.3	-----	6.3	-----	6.1
June 27	2	6.6	6.6	-----	6.2	-----	7.3
July 4	2	6.5	6.4	-----	5.8	-----	6.8
July 11	2	6.6	5.9	6.1	-----	6.0	6.6
Average		6.57	6.48	6.26	6.09	6.26	6.72

exposed for one or two hours. The changes in intestinal acidity did not parallel the anti-rachitic effect as measured roentgenologically. The anti-rachitic effect of the shorter exposure was much less than that of the longer exposure. It is very logical to infer that the structural adjustments in bone tissue that are required to convert rachitic bone to normal requires a longer period than the neurological and chemical adjustments required to normalize gastro-intestinal acidity.

We have just pointed out that in infantile tetany and in rickets there is a lowered acidity in the stomach and consequently a lowered acidity in the small intestine. The diminished acidity in the stomach results in the inability to separate calcium in ionizable form from milk. We know that cheese, such as Swiss cheese and Cheddar cheese, made by the rennet process of coagulation, is very rich in calcium, while types of cheese, such as cottage cheese, made by curdling with acid, are extremely poor in calcium content. The acid dissolves away the calcium associated with the casein. The diminished intestinal acidity is believed to militate against the absorption

of calcium. We know that the earthy phosphates, such as calcium hydrogen phosphate, are precipitated in an alkaline medium, but remain in solution in an acid medium. We now have to find experimental evidence to prove that an increase in gastro-intestinal acidity will cause a rise in blood calcium. If such be the case direct ingestion of acid or the increase of acid in the alimentary tract indirectly through vitamin D or ultraviolet exposure should be a therapeutic method of efficiency with which to combat both tetany and rickets.

The Relation Between Gastro-Intestinal Acidity and Blood Calcium

Von Noorden, in 1907, stated that insoluble calcium salts are dissolved in the stomach to a greater or less extent, depending on the amount of hydrochloric acid present. "They are only absorbed in the stomach in the merest traces, the greatest absorption occurring in the upper parts of the small intestine. There the calcium is transferred again into neutral or acid calcium carbonates and phosphates, and into salts of fatty acids, the amount taken up by the body depending on

the reaction of the intestine and on the quantity of carbonic acid, and upon the various fermentation acids." He also mentioned the fact that in case of gastric hypomotility associated with dilatation and stagnation, absorption is also reduced.

According to Klotz, the gastric acid exercises a favorable effect on the absorption of fat, protein and mineral matter. György has shown that the diffusible calcium salts of milk are increased by acidification as well as by tryptic digestion. The increase in diffusible calcium salts increases the chance of the organism for assimilating the calcium it needs. Calcium compounds, like calcium hydrogen phosphate and iron compounds, are absorbed in the upper part of the small intestine. This absorption must take place under acid conditions, for these compounds are precipitated in an alkaline medium. The condition of acidity in the small intestine is the result of the pouring in of acid from the stomach. The greater the acidity of the stomach, the greater will be the acidity of the small intestine. Only part of the gastric acid may be neutralized by the alkaline secretions in the small intestine.

Recently, Steenbock, Hart, Sell and Jones have reported that it is undoubtedly the acidity which makes possible the absorption of the difficultly soluble calcium salts from the intestine. Irving and Ferguson have studied the influence of acidity in the intestine upon the absorption in the blood of calcium salts. They found in an acid medium a more pronounced absorption, which underwent decrease under neutral or alkaline condition. That the administration of alkali should effect calcium absorption through the intestines has also been shown by Gebhardt and Schlesinger. They administered sodium bicarbonate. Calcium decreased in the urine and increased in the feces, as happens in the course of active rickets. Warkany reports that very slight absorption of phosphorus occurred in the rachitic infant that had not received irradiated ergosterol. Infants, however, that were receiving irradiated ergosterol from one to three weeks showed marked and rapid absorption of the phosphate. In the course of one hour the concentration in the blood serum rose from less than 6 to over 10 milligrams, i. e., from about 6.5 to 13.5 milligrams. Carlson also has shown that the diminished tonus and hunger contractions of

an empty stomach during parathyroid tetany were associated with a low serum calcium. Orr, Holt, Wilkins and Boone, too, have emphasized the fact that the acidity of the intestine is a factor in the absorption of calcium.

The relation of absorption of calcium or phosphorus, or both, to intestinal reaction has also been reported upon by Zucker, Zucker and Matzner, Jephcott and Bacharach, Redman, Willimott and Wokes. It has been shown that absorption is greater when calcium salts are administered by mouth when the stomach is empty. This greater absorption may be correlated with the fact that gastric juice taken from a stomach without food has a greater free acidity than that found in the stomach after a meal. Bergeim reported an increase in calcium and phosphorus absorption as a result of the administration of lactose, a sugar which adds to intestinal acidity through its fermentation to lactic acid. Bergeim called attention to the importance of the fact that human milk contains a much higher proportion of lactose than does cow's milk.

Calcium Absorption and Excessive Acidity in the Alimentary Tract

While it is true that increase in gastrointestinal acidity results in increased absorption and retention of calcium, we must not lose sight of the fact that rendering the alimentary tract excessively acid is liable to bring about a decrease in calcium retention. Wills, Sanderson and Patterson have shown that when hydrochloric acid milk, containing 20 per cent of decinormal acid was fed, calcium retention was decreased, and the calcium balance became negative. Shohl and Sato gave 250 c.c. of decinormal hydrochloric acid and noted an increase in the calcium elimination in the urine as well as in the feces. Hess states that when Scheer first recommended hydrochloric acid for tetany, he used his markedly acid milk preparation for the prevention and cure of rickets. In every instance he observed that the rachitic process was intensified as judged by clinical, radiological and chemical criteria.

Calcium Absorption in Relation to Ingestion of Acidified Foods

Other measures, besides definitely known anti-rachitic measures, also serve to increase the absorption of calcium and of phosphorus.

We refer to acids. These may find their way into the gastric contents through medication or through foods in which acids have been produced by fermentation or to which acids have been directly added.

Scheer and Salomon have shown that the feeding in tetany of milk acidified with hydrochloric acid caused an increase in serum calcium. With this simple treatment, the symptoms of tetany cleared up. Babbott, Johnston and Haskins found in infantile tetany that return to normal emptying time took place simultaneously with a rise in the serum calcium and with the disappearance of the clinical symptoms of tetany. Wilson, Stearns and Janney were able successfully to treat tetany by acid administration. Inouye obtained good results in experimental tetany by the use in the diet of galactose or lactose. This investigator contends that these carbohydrates stimulate the development of an acid-producing flora in the intestine.

Additions of acid to the diet are believed to affect directly the absorption of calcium and of phosphorus and to affect the cure of rickets and tetany. Zucker has offered evidence that acid added to a rickets-producing diet prevents the production of rickets. Flood has shown increased absorption of calcium in rickets in babies after the ingestion of hydrochloric acid milk. McClendon observed that the addition of alkali to a diet increased its power to induce rickets. Jones reported the cure of rickets through the ingestion of hydrochloric acid milk by rachitic puppies and rachitic children. Jones maintains that normal animals tolerate well a certain excess of alkali in the diets, but if the amount is sufficiently increased, the calcifying mechanism is reversed and rickets develops. Neutralization of the excess of alkali, however, initiates the healing process. Karelitz and Shohl and also Schultzer cured rickets in animals subsisting on a ration high in calcium, low in phosphorus and lacking in vitamin D by the addition of acid sodium phosphate to the diet.

Shohl and his co-workers, Bennett and Weed, in a later paper published their results of a more extensive investigation on the influence of the addition of acids or alkalies on a rickets-producing diet high in calcium and low in phosphorus. They added to the diet either sufficient trisodium phosphate, acid sodium phosphate, phosphoric acid, or phos-

phoric acid plus hydrochloric acid to give the same amount of phosphorus in all cases. The resulting food mixture after the addition of these various compounds was either alkaline, acid, or neutral. They all cured rickets, as judged from histological studies.

Analysis of the bones showed the greatest ash deposit with the neutral diets and smaller with the alkaline diets and least with the acid diets. Although these diets cured rickets the composition of the blood serum showed the characteristics of tetany with the alkaline diets and of rickets with the acid diets. It therefore seems plausible to postulate that the diets contained an excess of alkali or an excess of acid. The animals in the group receiving trisodium phosphate all showed muscular spasm. In the rats receiving phosphoric acid and hydrochloric acid no convulsions were observed. In the group of rats receiving sufficient phosphoric acid to make the diet practically neutral, all had convulsions and all died.

Some investigators are decidedly of the opinion that acidity or alkalinity of the diet is unimportant in the pathogenesis of rickets. McCollum and his associates found the same degree of rickets resulting from a diet containing calcium carbonate or the acid-forming salt, calcium chloride, given in equivalent amount. It is quite likely that the ingested calcium chloride raised acidity to such an extent that loss of calcium occurred instead of retention. Excessive acidity may also account for the fact that Shelling found acid diets to produce a severe degree of rickets. Mellanby, working with diets high in cereals, which are acid-forming, came to the conclusion that acid-base equilibria are unimportant in the causation of rickets.

The Difference Between Acid-Forming Food and Acidified Food

In referring to acidity and alkalinity in the diet it must be emphasized that investigators in this field do not always make the important differentiation between acid and alkaline diets and acid-forming and base-forming diets with relation to initial gastro-intestinal acidity and calcium absorption. An acid diet is one containing free acid, which contributes directly to increase in gastro-intestinal acidity and consequently to calcium absorption. Lactic acid milk or hydrochloric acid milk is an example of a food that constitutes an acid diet. An

acid-forming diet is one rich in cereals, eggs, meat, poultry or fish. It has no initial acidity whereby to increase the hydrogen-ion concentration of the contents of the alimentary tract. On the contrary, such diet decreases the free acidity in the gastro-intestinal tract because its high protein content contributes to the neutralization of free acid with the formation of so-called combined acid. A diet that is acid-forming, that is one which gives an ash predominantly rich in acid-forming elements, is apt to cut down the free acidity of the gastric contents and therefore to decrease calcium absorption.

Acid-Forming Salts in Rickets and Tetany

Equally good results in the treatment of tetany have been obtained by Freudenberg and György with the use of ammonium chloride. Haldane has shown that ammonium chloride is metabolized to a large extent like hydrochloric acid. Gamble, Ross and Tisdall observed the effect of ingestion of calcium chloride on the acid-base metabolism in infants. They found that the effect on acid-base metabolism of the injection of one gram of calcium chloride could be described as of the same extent as that produced by adding to the milk 75 c.c. of N/10 hydrochloric acid. The calcium chloride produced a lowering of blood bicarbonate just as ingestion of hydrochloric acid did. In a subsequent paper, Gamble and Ross came to the conclusion that it was not the calcium but the chloride ion that was efficient. They observed that calcium chloride produced a greater rise in calcium content of the serum than did the calcium-containing salt, calcium acetate. From these experiments we may infer that for raising blood calcium, calcium chloride is far more to be desired than the popularly used calcium lactate.

There are a number of salts that react in the body to form acid substances. We have mentioned two of these, ammonium chloride and calcium chloride. Haldane has reported that magnesium chloride and strontium chloride behave like the corresponding calcium compound in the production of a state of acidosis. Dragstedt was able to abolish tetany in thyro-parathyroidectomized dogs by intravenous injection of Ringer's solution in which strontium chloride replaced calcium chloride. Ammonium sulphate and magnesium sulphate, according to Gamble, Blackfan

and Hamilton, when ingested in considerable amounts also increase the acidity of the body fluids.

It would be interesting to know whether gastric tetany or tetany due to hyperpnea would also respond favorably to acid treatment. In the gastric type of tetany, produced by pyloric obstruction or by loss of hydrochloric acid from the stomach, McCann, MacCallum and his associates, and also Hastings and his collaborators have observed an alkalosis. In experimental tetany due to overbreathing, Collip and Backus, and Grant and Goldman have also found a greatly increased bicarbonate concentration in the blood. Both in gastric tetany and in tetany due to pulmonary over-ventilation, the calcium content of the serum may be normal. This fact is not to be taken in the sense that calcium has no relation to tetany. It is very probable that while the calcium content remains the same in the two types of tetany under discussion, the calcium ions diminish. Rona and Takahashi report that only about one-third of the calcium in the blood is ionized, and that calcium bicarbonate is non-dissociable. It is known that acid ingestion lowers the alkaline reserve and that the increased acidity would result in the greater formation of calcium ions. In this connection it is desirable to mention the work of Anderson and Graham. They demonstrated that a diminution of the alkaline reserve always leads to the disappearance of the sign of tetany in rickets irrespective of any change in the calcium content of the serum.

Methods of Increasing Calcium Absorption

Owing to the recent progress in the biologic sciences we have now four methods at our command for raising the calcium of the blood to its normal level, or for preventing loss of calcium through the large intestine. These methods involve: (1) the use of ultra-violet rays or ordinary sunlight; (2) the use of anti-rachitic vitamin (cod liver oil, irradiated ergosterol, irradiated food); (3) the use of parathyrin, a hormone recently isolated by Collip from the parathyroid; (4) the use of such acid as hydrochloric acid or compounds metabolizing like it, as ammonium chloride or calcium chloride. The acid in the case of infants is used in conjunction with milk feedings. Other acids besides hydrochloric—acetic, lactic and citric—have also been strongly recommended.

Pathogenesis of Rickets—Theories of Calcification

Rickets is accompanied by a decrease in gastro-intestinal acidity. Ultraviolet or sunlight acting on the skin irradiates the ergosterol present therein. The irradiated ergosterol raises the gastro-intestinal acidity, increases the absorption and retention of calcium and phosphorus and cures or prevents rickets or infantile tetany. The specific effect of sunlight or ultraviolet is therefore the result of a chemical action. Hess and Weinstock irradiated by means of the mercury vapor lamp a section of excised human skin and then fed it in definite quantities to a series of white rats. The animals did not develop rickets. The ergosterol in the skin became activated. On the other hand similar quantities of un-irradiated skin failed to protect the animals against rickets. Since very little irradiated ergosterol can prevent or cure rickets, it follows that only a small area of skin need be irradiated in order to produce anti-rachitic effects.

The mode of entrance of ultraviolet leads us to the belief that anti-rachitic substances should retain their potency when they reach the blood through channels other than the alimentary tract. The results of experiments of Hess, of Lesné, and of Kramer bear out this idea. When cod liver oil which contains activated ergosterol, or when the unsaponifiable portion which holds the ergosterol, or when irradiated ergosterol itself is injected subcutaneously, it still retains the ability to cure rickets.

The lowered gastro-intestinal acidity in rickets and infantile tetany accounts for the lowered absorption of calcium and phosphorus, but does not satisfactorily explain failure of calcification. Scurvy, pellagra and other deficiency diseases show low or absent acidity, yet fail to show the typical histological or roentgenological pictures of rickets observed in bone, even though absorption and retention of calcium is interfered with. Sunlight or ultraviolet does not cure or prevent these diseases. Furthermore, it may be stated that subcutaneous injection by Grosser of calcium and phosphorus compounds did not lead to calcification.

Calcification in Vitro

It is interesting to note that in inanition, when calcium and phosphorus are not in-

gested, calcification proceeds in both rachitic infants and in rachitic animals.

In explaining the pathogenesis of rickets, we are led to postulate not only a gastro-intestinal factor but also local factors operating in bone in the zone of calcification. The work of Shipley with reference to calcification in vitro throws some light on the subject. He showed that rachitic cartilage still retains the ability to calcify. Several important conditions must be complied with, however, before calcification can go on. One condition to be satisfied is that the presence of a sufficient amount of bone-forming salts must be furnished in the medium. Shipley observed that when a section of the epiphysis of a rachitic rat is immersed in serum and incubated for forty-eight hours, calcification took place in the proliferating zone of cartilage if the products of the concentration of calcium and phosphorus was less than 35. Shipley, Kramer and Howland modified the method and carried out the test by employing a medium containing bone-forming salts.

Another condition to be satisfied is the reaction of the calcifying solution. The optimal pH is between 7.25 and 7.35. If the solution is too acid, calcification does not take place. If too alkaline, precipitation instead of calcification occurs. It is interesting to state in this connection that Bosányi has shown that in rickets the cartilage is more alkaline than under normal conditions. He found the pH in normal cartilage to be 7.2 to 7.0, while cartilage in rickets was more alkaline, having a pH of 7.6. Another condition that must be fulfilled is the proper proportion of magnesium. McCrudden and others have shown that magnesium is present in excess in bones in rickets and in osteomalacia. Calcification occurs much more readily in the absence of magnesium. Kramer, Shelling and Orent state that magnesium ions exert an inhibitory effect on calcification in vitro and that the increase in magnesium which suffices to inhibit in vitro calcification might conceivably occur in the body fluids.

The Enzyme Concerned in Ossification

In attempting to explain lack of ossification in rickets, we must make mention of an enzyme present in the epiphyseal junction of bones, especially those in which calcification is taking place. This enzyme is an esterase. It acts on calcium hexose-monophosphate or

salts of glycerophosphoric acid, liberating phosphate ions, which are essential in the formation of the compounds of calcium and phosphate occurring in bone. The esterase not only occurs in bone and in ossifying cartilage, but is also present in teeth as well as in almost all other tissues. In the osseous system it seems to be secreted in the region of the osteoblasts and near hypertrophic cartilage cells.

The enzyme is actively concerned in ossification. By the action of bone extracts on unclotted whole blood, the amount of inorganic phosphate in the blood is increased. Since the esters hydrolyzed by the bone enzyme are present entirely in the corpuscles, it is evident that they are able to diffuse from the corpuscles to the plasma. In this event the corpuscles act as a reservoir for minerals necessary in bone formation. A considerable portion of calcium and of phosphorus exists in un-ionizable form, which must be converted to the ionized form before playing a part in fixation in bone as a salt of calcium phosphate. The deposition of fresh calcium phosphate has been demonstrated in bones taken from rachitic animals and immersed in a solution of calcium hexose-monophosphate or calcium glycerophosphate kept at 37° C. and at the optimal range of hydrogen ion concentration for the enzyme, which is pH 8.4 to pH 9.4. This high pH suggests the possibility that the reaction of tissue fluids in a region of active ossification may be rendered more alkaline than the blood. The increase in alkalinity provides also a favorable condition for the deposition of calcium salts. The latter two statements are not, however, in harmony with the findings of Bosányi and of Shipley, Kramer and Howland. Bosányi, as we have already stated, found the pH in normal cartilage to be 7.2 to 7.0, while cartilage in rickets had a pH of 7.6. Shipley, Kramer and Howland observed that calcification took place *in vitro* with a calcifying solution of an optimum hydrogen ion concentration lying between pH 7.25 and pH 7.35.

In view of the role that the esterase may play in calcification, it is very surprising to learn that rachitic bones contain at least as much of the enzyme as normal bones. It is evident that in rickets failure to calcify does not imply insufficiency of the enzyme. Robinson and Soames fed rats a diet containing sufficient calcium and phosphate but deficient

in vitamin D. The blood contained a normal amount of inorganic phosphate and of the phosphoric ester hydrolyzable by the bone enzyme. The deficiency in calcification resulting from such diet could not be due to any shortage in the blood in organic phosphate, nor to the specific phosphoric ester, nor to the enzyme in the bone by which this ester is hydrolyzed. In a series of rats fed with a rachitic diet very deficient in inorganic phosphate, the concentration of inorganic phosphate and of the phosphoric esters in the blood was below normal. Cod liver oil raised the inorganic phosphate almost to normal. In rats fed with this phosphorus-deficient diet, defective calcification seems to be due mainly to a deficiency in phosphorus in the form of phosphate ion. This, however, is not the case when the defect in calcification is caused by lack of the fat-soluble vitamin.

The Presence of a Water-Soluble Anti-Rachitic Factor in Bone Marrow

Additional light upon the process of calcification has been shed by Bosányi. This investigator attributes lack of calcification to functional derangement in the bone marrow. He isolated from normal bone an anti-rachitic substance formed in the bone marrow. He found it in normal bone but not in rachitic bone. It is water-soluble and can be extracted from the spongiosa and from the bone marrow. Subcutaneous administration of aqueous extracts of normal bone marrow causes the healing of rachitic bones in the rat.

The experiments of Shipley, of Bosányi, and of Robinson and Soames indicate beyond doubt the presence of local factors concerned in the process of calcification. Furthermore, there may even be marked differences in local factors in the different parts of the same bone, for when rickets heals, calcification does not occur simultaneously in all regions of the affected areas.

Systemic Factors in Defective Calcification

In addition to local factors involving the gastro-intestinal system (failure of absorption) and also the osseous system (failure of calcification), we must not overlook the fact that a systemic factor may also play a significant role in rickets. The findings of Iverson and Lenstrup indicate that such systemic factor is at work. In 1919, they first demonstrated that rickets was associated with a definite chemical alteration in the blood. They observed that the concentration of serum

phosphorus was decreased, while the serum calcium is maintained approximately at the normal level. These blood findings, however, are now being controverted. Block and Faber studied 71 infants between the ages of two months and two years who showed signs of clinical rickets. They found no constancy either in the figures for serum calcium or for serum phosphorus. They recorded six infants with low serum phosphorus and normal serum calcium, fifty-two infants with calcium and phosphorus decreased, twenty-three of whom showed tetany, and thirteen infants with low calcium and normal phosphorus level, all of whom showed tetany. Hess, Weinstock, Rivkin and Gross reported the experimental production of a type of rickets which persists in the face of high concentrations of serum calcium and of serum phosphorus. Under conditions of a normal serum calcium and serum phosphorus we may attribute failure of calcification in the bones to disturbances in the zone of calcification.

Perhaps the root of the pathogenesis in rickets lies in the disturbance of acid-base equilibrium. We do know that gastro-intestinal acidity is closely involved with this equilibrium and that calcification is a process dependent on hydrogen-ion concentration. That disturbances in acid-base equilibrium do occur in rickets is evident from the work of Hodgson who pointed out an increased acidity of urine in rickets, and from the work of György who reported that treatment with cod liver oil or with ultraviolet light generally brought about an increase in the alkaline reserve, and from the work of Blum, Delaville and van Caulaert who proved that ultraviolet rays decrease the acidosis accompanying rickets. That ultraviolet raises the alkaline reserve of the blood in diseases other than rickets has been shown by McCasky and Balderey and Barkus, by Lenhardt and Chaptal and by Jenma. Yet we cannot fail to recognize that other conditions besides rickets develop a tendency to acidosis without revealing the findings characteristic of failure of calcification.

Conditions Leading to Defective Calcification

A study of the factors leading to defective ossification is very important in bringing to us an understanding of the process and also in explaining to us the exact functions of ultraviolet in the animal organism. At the

present state of our knowledge any one of the following conditions may lead to failure of calcification.

1. Insufficiency in the intake of calcium or of phosphorus, or an intake representing an improper ratio between the quantities of calcium and phosphorus.
 2. Insufficiency of calcifying stimulants such as vitamin D or ultraviolet rays.
 3. Disturbances in the intestinal mechanism of absorption so that insufficient calcium and phosphate reach the blood.
 4. Lowering of the concentration of calcium ions in the plasma either as the result of a diminution in the total calcium content, or a disturbance in the equilibrium between the ionized and un-ionized portions thereof.
 5. Lowering of the concentration of phosphate ion corresponding with the bone phosphate, whether as a result of a diminution in total inorganic phosphate or a shift in the equilibrium between the various phosphate ions (change of pH).
 6. Failure of the cartilage and bone cells to secrete the enzyme that liberates phosphate ions from esters of phosphoric acid present in the blood.
 7. Deficiency in the supply of the esters of phosphoric acid normally present in the blood which is hydrolyzed by the esterase found in ossifying cartilage.
 8. Lack of the water-soluble antirachitic substance extracted from bone marrow by Bosányi.
 9. Failure of the mechanism, if there be one, by which the pH is raised within cartilaginous tissue so that the esterase present in ossifying tissue fails to reach its favorable hydrogen ion concentration to affect the hydrolysis of esters of phosphoric acid.
 10. Alteration in the permeability of the membranes of blood corpuscles or capillary walls within cartilage.
 11. Disturbances in the endocrine glands, especially in the parathyroid glands.
- Insufficient intake of calcium or phosphorus or poor absorption of these elements from the intestine may lead to the presence in the blood of insufficient phosphate ions and calcium ions with which to construct the compound of calcium and phosphate or of calcium and carbonate required for ossification. In organic serum solutions with a product of calcium and phosphorus less than 30, Shear and Kramer observed that the serum is un-

dersaturated with respect to calcium acid phosphate (CaH PO_4), and that under such condition no calcification took place. Viewed from a different angle, we may state that if the product of the ionic concentration of calcium ions and HPO_4 ions falls below the solubility product K in the equation below, the plasma would remain unsaturated with respect to CaHPO_4 .

$$K = \frac{\text{Ca}^{++} \times \text{PHO}_4^{--}}{\text{CaHPO}_4}$$

If we take into consideration local factors, we may postulate that deposition of phosphate would still occur under the above circumstances, provided an increase in inorganic phosphate in the blood would result from hydrolysis of the phosphoric ester carried in the blood, and provided that sufficient phosphate ions were liberated to raise the product of the ionic concentration above the constant, K . Failure of either the phosphoric esterase or insufficiency in phosphoric ester would lead to deficient calcification, since the necessary local increase in phosphate concentration would not occur. The participation of the phosphoric esterase in the process of calcification has been supported by considerable experimental facts, although we do not find evidence to show disturbance in the enzymic process or diminution in the enzymic substrate to account for faulty calcification in rickets.

In looking for an explanation of the process of calcification we must not overlook the rôle that may be played by changes in permeability. The supply of the ester at the zone of ossification may be short owing to changes in permeability, even though the ester may be present in sufficient quantity in the corpuscular elements. It is also conceivable that changes in permeability of the cartilage or of the capillary walls may, by affecting the Donovan equilibrium, alter the relative concentration of calcium and phosphate ions in the plasma and within the cartilage. Changes in pH in the blood plasma and within the zone of ossification may also play a significant part in the deposition of calcium salts.

There are many interesting views held with regard to the mechanism of calcification. According to the view held, some claim that the defective calcification occurring in rickets is the result of faulty intestinal absorption or the result of inhibition or retardation in the epiphyseal zone of calcification. Very recently

Brown and Shohl have brought out some interesting facts with reference to the intermediary metabolism of calcium. They observed that the effect of irradiated ergosterol in moderate doses caused increased deposition of calcium salts at the epiphyses, while large doses resulted in a negative calcium balance and marked demineralization of the bones. They also observed the remarkable fact that when rickets is present, the administration of comparatively large doses of irradiated ergosterol induced calcification at the epiphyses in spite of the demineralization of the bones. They maintain that irradiated ergosterol is concerned in the intermediary metabolism of calcium. The sterol induces calcium salts to dissolve from the shaft of the bone. The salts are then deposited in the growing end or epiphysis.

The Part Played by Ultraviolet Rays in Calcium Metabolism

We do not as yet understand the mechanism of ossification or of calcium metabolism; nor do we as yet fully understand the part played by sunlight or ultraviolet in these processes. That a better understanding is highly desirable is evident in view of the fact that calcium metabolism is involved in the process of immunity and that sunlight or ultraviolet rays decrease susceptibility to infection.

We do know, however, that sunlight or ultraviolet does play a very significant part in the process of calcification and in the metabolism of calcium, and that it does insure the most efficient biologic use of calcium. The diseases most marked by disturbance in calcium metabolism—rickets, osteomalacia and infantile tetany—show a greater incidence and a greater severity in symptoms in the months which are most deficient in sunlight and consequently in ultraviolet radiation. In each disease mentioned the disturbance in calcium metabolism seems to be most marked in one direction. The most conspicuous fact regarding rickets is failure of calcification of the bony structures of the body. In osteomalacia it is decalcification of the bones. In infantile tetany it is a deficiency in the calcium ions present in the blood. Whatever may be the symptomatic picture in rickets, in osteomalacia or in tetany, we have to take cognizance of the significant fact that sunlight or ultraviolet is curative as well as preventive. In view of the beneficial effect of

sunlight or ultraviolet rays we must regard these diseases as deficiency diseases and place them in the same category as scurvy, xerophthalmia, beriberi and pellagra.

Civilization in its aggressiveness should not fail to realize that living without the sun or away from the sun is a step forward in the direction of the physical deterioration of its functioning unit, the human being.

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TREATMENT OF MALIGNANT TUMORS OF THE URINARY BLADDER BY DIATHERMY *

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ST. LOUIS

The application of diathermy to bladder tumors has steadily gained in favor and is now an established method of destroying these conditions. The results obtained from the method are dependent on many factors which makes it difficult to evaluate the procedure by percentage tables, but when a cancerous growth with vicious aspects is treated by diathermy and the tumor disappears and the patient stands before us three or four years after that date with no evidence of return, we doubting Thomases are convinced that that method deserves a place in the treatment of these dreadful conditions. We do not waste time arguing which method is best in the treatment of bladder tumors but without bias, make use of radium, deep x-ray therapy, extirpation or diathermy as the clinical aspects demand. We do not find a place for the various serums recently exploited in the press because they are secret formulas and admittedly unproved by those experimenting in this field. When the infallible cure for cancer in all its phases and stages is discovered, it will need no advocates but the method will prove itself by its results and be accepted universally just as insulin for diabetes and liver diet for pernicious anemia. We, therefore, conservatively state that diathermy is one of the accepted successful methods of treatment and we have patients who are presented here today who were treated by this method and who, we believe, would otherwise have been in their graves.

Infiltrating carcinomata are best treated by the suprapubic exposure and direct application of diathermy. Care should be taken to prevent transplantation of tumor tissue, all exposed surfaces covered by gauze and the wound flushed with 70 per cent alcohol at the conclusion of the treatment. Ethylene gas can-

not be used safely with the electrical sparking. Spinal anesthesia, 200 mgm. Novocain controlled by ephedrin gives excellent exposure and satisfactory anesthesia which will last for one hour and thirty minutes; therefore no time should be lost in gaining exposure and applying the diathermy. An electrode ranging from the size of a dime to a five cent piece is applied in one area for at least ten minutes and shifted until the entire mass and its closely adjacent tissue are treated. The strength of the current is determined by the heat generated in the tissue, determined by the finger in the rectum or vagina, and close to the electrode. It should be as hot as the gloved finger can endure. The effort is made to obtain the thermal death point of carcinomatous tissue but must fall short of the death point of normal tissue. It is advisable to fall short of eradicating the tumor on the first attempt rather than be heroic and cause a perforation. We do not allow the suprapubic opening to close, and thus we can observe the condition of the area after sloughing has taken place. Should further evidence of tumor be present, diathermy is again applied or radium implantation resorted to. The opening is only allowed to close when we are satisfied the tumor has been eradicated. Sloughing and secondary bleeding are the rule, the bleeding occurring in about ten days which is always mild and never serious. Should it be profuse, control of the situation is maintained by packing through the suprapubic opening.

Absorption from the necrotic areas causes toxemia and weakness with fever which calls for supportive measures in the senile patient. Pyelonephritis or ureteral block due to oedema is not uncommon, the former being manifested by fever and often chills, the latter by unilateral colicky pain. Should the ureter be in a precarious position, a ureteral catheter

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inserted prior to the operation is good procedure.

The results obtained from diathermy are encouraging. Thoroughness of application and subsequent observation of the case at regular intervals are essential to eradication of the tumor. For example:

Mr. H. D. D. of Alhambra, Illinois, age 64, had a tumor which was diagnosed by cystoscopic appearance and pathological section to be infiltrating carcinoma involving the right lateral and posterior wall of the bladder, adjacent but not involving the ureter. Fulguration transurethrally failed to relieve the symptoms. Radons implanted through the cystoscope did not remove the growth, so that seven months after the first time the patient was seen, suprapubic diathermy was given. Seven months following this a new tumor growth was observed on the dome of the bladder in the line of the operative scar, which undoubtedly was the result of a transplant. Suprapubic diathermy was again administered. Now three years since the first observation, the man is in a good state of health without pain, and cystoscopic observation in July, 1930, shows no evidence of the tumor.

Mr. W. L. P. of St. Louis, had a large sessile carcinoma filling one-third of the bladder. Suprapubic diathermy was given five years ago and all cystoscopic examinations since that time have shown a smooth mucous membrane with no evidence of any tumor. He works regularly and reports to us every six months.

Mrs. H. A. of Monmouth, Ill., had an infiltrating necrotic carcinoma of the bladder filling a large portion of the bladder and preventing a satisfactory cystoscopic view. Suprapubic diathermy was performed. She

developed pneumonia with a lung abscess following the operation and had a stormy convalescence. She has been observed every six months since, and now three years since the operation, there are no signs of tumor.

Mr. J. W. D. of St. Louis, had a sessile tumor of the right lateral wall of the bladder of the infiltrating type. Suprapubic diathermy was given in April, 1928. In February, 1929, he had persistent pyuria with attacks of septic chills and fever and right renal colic. We were unable to locate the right ureter or discover any dye coming down on that side, so decided to explore the right kidney. At operation, a normal kidney was found and no evidence of perirenal abscess. The wound was closed and the patient, although having a persistent pyuria has not had any further attacks. He has remained healthy, at work daily and gained weight. The last cystoscopic examination was performed in May, 1929, and the bladder was found to be in a satisfactory state.

We are citing the above successful cases to satisfy the claim that diathermy will destroy infiltrating carcinoma.

The stage of advancement, the degree of malignancy of the growth, the site of involvement, the thoroughness of the treatment—all have a bearing on the recovery and consequently many cases go on to their death.

The operative mortality is low and will be even less with the freer use of spinal anesthesia. We had two operative deaths, one due to fecal fistula, and the other due to absorption of a large sloughing area caused by burning of the indifferent electrode on the buttock because of imperfect contact.

Interpretation of Blood Counts in Radium and X-Ray Workers

In an interesting article in *The Lancet* of January 3, 1931, Dr. J. C. Mottram, of the Radium Institute, arrives at the following conclusions:

When interpreting the blood counts of radium and x-ray workers, attention should be especially directed to the polymorphs and lymphocytes, because a diminution of these cells is an early effect. Counts become significant when they fall below the lowest normal, 3,000 for polymorphs and 1,500 for lymphocytes. When a series of counts are available, a steady and persistent fall in these cells, though not reaching so low a level as the above limits, indicates that the worker is be-

ing affected, especially if temporary recovery occurs during holidays.

A mild polycythemia is an early change in the red-cell count, but is not greater than found in young persons leading strenuous lives. The later changes in the red cells, consisting in diminished number with a high color-index, are of grave portent, and only from gross neglect to take protective measures can such a blood condition occur.

Experience shows that if the recommendations of the Radium and X-Ray Protection Committee are carefully followed, abnormalities in blood counts are avoided. Abnormal blood counts strongly suggest that an insufficient protection is being provided.—*Brit. Jour. Rad.* 4:131, (March), 1931.

PROSTATIC HYPERTROPHY: TRANSURETHRAL ELECTRO-SURGERY OF THE PROSTATE*

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A half century has elapsed since Enrico Bottini, of Pavia, Italy, drew the attention of the medical world to his galvano-cautery knife for the relief of prostate obstruction. He named his instrument an electro-prostatome. Bottini must thus be credited as the originator of all electro-surgical and cautery methods of handling obstructions at the vesicle neck. Unfortunately, the Bottini method of dividing the floor of the prostate did not fulfill the expectations of its author; its application scarcely extended beyond the experimental stage. His operation was never popular because of the absence of any illuminating facilities. The operating field was in total darkness which prevented exact determination of the amount of tissue to be destroyed. If hemorrhage occurred one could not control it with the same efficiency as at the present.

The present successful work in transurethral prostatic surgery should be attributed to the evolution and perfection of the cystoscope and the advances that have been made in the use of cautery and high frequency currents. No claim of priority is made in this work. We have only assembled and perfected a technic which has been very successful in our hands. It is our belief that this work is as yet in its infancy and that there will be greater improvements in technic in the near future.

At the present time we are employing the biterminal d'Arsonval high frequency current, under full vision, with the cystoscope (using a special long flexible needle) preceded by local infiltration anaesthesia. By this method one can definitely destroy and shrink an area of the obstructing prostate approximately 2 to 3 cm. in diameter. The patient often experiences immediate relief after his first cauterization; if this does not follow after a relatively short period, cauterization is again resorted to in order to destroy more prostatic tissue.

About ninety percent of electrosurgical operations performed by us have been accomplished in our office. We have hospitalized

only those that were in very poor physical condition or were very poor operative risks. It has been our experience that many of these patients will refuse any radical operation but will consent to measures that are suggestive of palliation.

About fourteen years ago we first attempted to use transurethral surgical diathermy on the hyperemic or hypertrophied *veru* for relief of premature ejaculation. At that time we used the Oudin monoterminal current, which, on account of the high voltage quality of the current, resulted in untrollable sparking. We also treated obstruction at the vesicle neck, at that time by this same method. Although the results were very good, the majority of our patients complained of considerable pain. The method of anaesthesia then employed was a topical application of cocaine or alypin with a Lewis depositor. We have since improved the method of anaesthetizing these parts by the use of an infiltration technic which has made the procedure practically painless.

The median bar obstructions and large prostatic obstructions can also be managed by this method. After years of conservative study I am now convinced that electrosurgery of the prostate is simple, very effective, and one that any well equipped and experienced urologist can carry out in an office procedure. My results have, thus far, been very gratifying. For example, my first patient thus operated upon (fourteen years ago) is still alive, and relieved of his bladder distress. No unusual complication has thus far been observed. The mortality has been very low and has been commensurate with the number of poor operative risks. The method should, therefore, have a wider appeal because it relieves a major condition by a minor operation.

It has not been an easy task to change from the established method of removing the prostate by surgical enucleation to that advocated in this paper. I am, however, encouraged in my stand because of the results obtained. Many of these patients suffered from associated complications such as cardio-vascular

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diseases, debility, hypertension, oedema of the legs, renal insufficiency, but withstood the ordeal of electrosurgery surprisingly well in spite of their infirmities. Prostatic hypertrophy is not only regarded as a mechanical obstruction of the vesicle neck, but evidently affects the entire body as a whole. We are well aware that prostatic obstruction resulting in varying degrees of urinary retention, exerts a direct effect on renal function, not only as a result of obstruction but because prolonged retention causes back pressure, dilated ureters, reflux, and ascending infection. If Pyelonephritis is present it usually is progressive, and after long standing becomes irreparable.

In spite of statistics, which show an operative mortality of prostatectomy of 2 to 3 per cent in the hands of the urological surgeon, and as high as 40 per cent by some general surgeons, we have undesirable situations confronting us when least expected.

Common post-operative complications of radical prostatectomy are hemorrhage, shock, embolism, renal insufficiency, and even infection. In perineal prostatectomy we sometimes have incontinence and dribbling. Epididymitis occurs in approximately 20 per cent of the cases. Renal insufficiency, cardio-vascular disease and pulmonary lesion are responsible for 50 per cent of the deaths following prostatectomy. In the earlier days of prostatic surgery, the mortality was much higher. It has been shown that supra-pubic cystotomy in the presence of acute retention has a definite mortality.

Many urologists do not consider the fact of recovery from prostatectomy a test of the skill of the surgeon. Sepsis in relation to enlarged prostate and prostatectomy is a failure of surgical methods. Obstruction after the operation of radical supra-pubic prostatectomy for enlargement of the prostate varies many times from a slight difficulty in micturation to complete obstruction with fistula. Then, too, the large hollow cavity following enucleation allows accumulation of urine and pus, causing a recurrence of simple enlargement, stone formation, and even malignant growth. Slow healing usually takes place.

One of the perplexing problems of the urologist is to determine when benign enlargement of the prostate gland requires surgical attention. Some observers noted that 50 per

cent of all men past the age of fifty have some enlargement of the prostate. As many as 26 per cent of the cases diagnosed as benign at the time of operation, with microscopical examination of the removed specimen have proved malignant in after years. This has been found true in the follow-up by the larger clinics. If that is the condition that confronts us, and we undoubtedly know it prevails, then cauterization by electrosurgery and destruction of an area 2 or 3 cm. in diameter, with the resultant shrinkage of tissues, should be the method of choice when there is a suspected malignancy of the prostate.

It is obvious to us that given an individual who has a large prostatic hypertrophy and who can tolerate cystoscopy, we can destroy the median lobe, also the intra-urethral lobular obstructions and the lateral lobular obstructions in different sittings. It is our opinion that the intra-urethral lobular obstructions are at times a great factor in complete retention.

Caulk is to be commended for his persistence and perseverance in his Cautery Punch work. He first called attention to his method in 1919. Since then he has continuously published his further experiences and has defended its virtues in spite of much criticism. At first he only operated on median bar prostate and vesicle neck stricture, but since then he has been using his cautery punch method on the larger prostatic obstructions. Caulk's punch is an improvement of Young's punch. It has an electrically heated hollow platinum electrode with which he is able to bite out several large pieces of prostatic obstruction at each sitting. At the 1930 meeting of the American Urological Association, in New York, there were many new and different types of cautery instruments made by Wappler, designed by Day, Kirwin, Foley, McCarthy and Ravitch. Bumpus and Braash, of the Mayo Clinic, have used the method of Young's punch but have followed it with electrocoagulation of the bleeding points through an improved Braash cystoscope. Bumpus claims that this procedure should only be used in selected cases of median bar obstructions and stricture of vesicle neck. Collings, of New York, cuts through a median bar with a Wappler-Collings radio knife arrangement, through a McCarthy panendoscope, but does not destroy enough tissue to give relief in hypertrophy of the

prostate. He is of the opinion that his instrument should only be used in selected cases of stricture of the vesicle neck, fibrous contraction and carcinoma of the prostate. He used caudal anaesthesia or gas in some cases. Maximilian Stern has designed a cystoscope with which he is able to cut a ribbon-like strip about one-third cm. in diameter, through the median bar. Luys, of France, has used the method of surgical diathermy through a French cystoscope many years ago and should be considered a real pioneer in this type of work. The French use a picturesque expression to describe the operation:—"Forage le Prostate".

Remijne, of the Coolsingel Hospital, at Rotterdam, in 1926-27, met with considerable success in the treatment of prostatic disease by electrocoagulation; though aware of the fact that the results obtained then were not final, the provisional outcome was encouraging. Those submitted to electrosurgery were cases deemed poor operative risks, such as very old men suffering from heart affections and disease of blood vessels and with deficient kidney function.

There is definite evidence which shows that more urologists are changing from the radical removal of the prostate and are leaning to the more palliative measures. We have re-operated some of our cases as often as five times. These cases are operated on at five week intervals because this is the average length of time of healing. The patient has the interim to relieve his back pressure, improve his cardio-vascular condition, and to relieve his reflux and atonic bladder by irrigations and treatment.

We might be questioned as to whether or not we have completely cured these patients without recurrence. We repeat the electrosurgery as often as we deem it necessary and destroy and shrink tissue 2 to 3 cm. in diameter until satisfied with the result. At least, we have not opened up avenues of infection by this method of operation. One of the great complications in radical surgical prostatectomy is embolism. We have not had any complications of any consequence in connection with electrosurgery.

We have consistently observed that many of these patients have obtained an immediate relief following the first cauterization operation. After the edema and inflammation has subsided following operation, the residual

urine is found to be less than before the operation. We find that these patients must be given unusually good pre- and post-operative care. We attempt to keep the patient at his duties, ambulatory, and to cause him so little discomfort that he will allow us to repeat the procedure, if necessary.

Surgical diathermy offers these advantages in the treatment: the blood vessels or lymphatics are sealed by electrosurgery and therefore no danger arises from dissemination of tumor cells, embolus, or from systemic infection. No surgical shock is evident.

Preoperative care:—We exercise the same extreme precautions on the patient in this work as we have in radical prostatectomy. A complete physical examination and blood chemistry and estimation of renal function is made. We have a complete roentgenological examination of the urological tract, also a roentgenological and electro-cardiographic study of the cardio vascular system. We note reflux, if present. We are constantly on the lookout for malignancy. These patients should be decompressed slowly, and while doing this the urethra should be handled gently and not traumatized. Great care should be exercised at cystoscopy. In fact, we have had to work a considerable length of time on some patients before we could subject them to cystoscopy.

Many prostatic patients have a foul smelling, ammoniacal, badly decomposed, and badly infected urine. In these cases we clean up the urine in the bladder as much as possible, previous to electrosurgery. A badly infected urine does not permit the proper healing of the area which has undergone cauterization.

Method of operation:—A hypodermic injection of scopolamine, gr. 1/150 and morphine gr. 1/4, is given one-half hour before electrosurgery. Urethral anaesthesia is obtained by the injection with a rubber bulb syringe of four per cent novocaine solution into the anterior and posterior urethra. A McCarthy operating cysto-urethroscope is introduced. With a special flexible needle, twelve inches long, that part of the prostate which is to be cauterized is infiltrated with a two percent novocaine solution in normal saline.

The d'Arsonval biterminal polar current is not difficult to control. The current used may register 2500 M. A., on a short circuit, but

the spark should rarely exceed $1/16$ of an inch, amperage or intensity (diffusion of coagulation) will be regulated by the respective speed or tardiness with which the current is turned on and off. More prolonged and intensified insertions will be required when the prostate is fibrous and not spongy. It is impossible to instruct one in regard to the

a larged sized 10 F electrode is introduced to the median lobe, which is first attacked. Experimentally, outside of the bladder, the amount of prostatic tissue that can be destroyed at a sitting is surprising. This work should not be done hurriedly and all supportive measures which the urologist would employ to assist in preoperative prostatectomy

Fig. 1



Median lobe of prostate. Needle ready to be inserted.

Fig. 3



Electrode before electro-surgery.

Fig. 2



Needle inserted. Infiltration anaesthesia of median lobe of prostate.

Fig. 4



Electrode beginning electro-surgery.

depth and frequency of insertion, because the character of the prostate and the current employed is such a variant factor as to prohibit exact details. A good foot-switch is essential. For the destruction of prostatic tissue,

should be used in cases that are operated by the method advocated in this paper. Bubbles will arise frequently. To keep the field clear, we make use of large quantities of sterile, distilled water. The length of time consumed

for an operation of this nature is about thirty-five to forty minutes.

Post-operative:—The patient should be constantly watched for symptoms of dehydration and, if necessary, as in the case of the larger hypertrophies of the prostate or those with complete retention, indwelling catheter is inserted into the patient following cauter-

cystoscopy; all cases that have had their urethra traumatized by instrumentations, and senile patients who have their mentality impaired.

The shrinkage of the adenomatous tissue is greater than one would anticipate. No active hemorrhage has been experienced which would cause any concern, and no great

Fig. 5



Cauterization of median lobe.

Fig. 6



Deeper cauterization of median lobe.

Fig. 7



Cauterization of lateral lobe.

Fig. 8



Deeper cauterization of lateral lobe.

ization. In some cases we have had terminal staining which was of no consequence.

There are some contra-indications to electrosurgery. Cases with a tortuosity of the urethra, due to an hypertrophied prostate that does not allow passage of an instrument for

amount of sloughing has been observed to take place. In case of unexpected hemorrhage one always has the alternative to again cystoscope and cauterize the bleeding point. The scar from surgical diathermy does not cause stricture or contracture but causes a

shrinkage of the adenomatous tissue. At least one notes nothing resembling stricture from this procedure.

Epididymitis has occurred in some of our cases. Post-operative chills and fever have also been present. This can be accounted for by the presence in some cases of infected urine. Where complete retention is present, we employ a retention catheter. The improvement has been immediate and the patient is thus relieved of some of his bladder distress. It has been surprising how suddenly the amount of residual urine would drop.



Special Needle for Infiltration Anaesthesia Prostate.



Special Electrodes for Cauterization of Prostate.

There was a slight terminal staining from seven to fourteen days in a few of our cases, and no hemorrhage to cause any concern, with the exception of one case.

I predict that the time is not far off when less operative work (enucleation) will be done on the hypertrophied prostate, and that the procedure will be on the more conservative lines of palliation.

In conclusion I should like to cite a single case treated in the manner described above.

R. T., watchman, 70 years of age, waxy color, anemic; on rectal examination an enlarged, soft prostate was found. Residual 300 cc. Cystoscopy disclosed a large, hypertrophied prostate with median and lateral lobes and atonic, trabeculated bladder and a small diverticulum in fundus. His blood chemistry was high. This man refused prostatectomy. We destroyed an area in the median lobe, about one centimeter and a half in diameter. After working on this patient, with four other successive electro-surgical operations in the two lateral lobes, the patient was able to void without difficulty. This work extended over a period of six months, which was completed one and one-half years ago. The patient then had a very slight residual of one-half ounce, and his urine was fairly clear. He has since gained forty pounds in weight and is still alive. The result obtained in this case has been very satisfactory. He has reported to his family physician that he is doing very nicely, and that he has had no bladder distress at the present time.

Summary

1. Simplicity of method is a basic feature of the operation.
2. The patient's life is not jeopardized and there is no immediate danger by this palliative measure.
3. This is an office procedure with local infiltration anaesthesia.
4. Obstructions that can be handled in no other way, such as carcinoma of the prostate, can be taken care of by this transurethral method.

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Discussion of Lewis and Carroll, and Frischer Papers

Dr. Bransford Lewis (St. Louis, Mo.): First, I want to say a few words with regard to the excellent contribution of Dr. Nelson. I think that he takes a very sober, well-rounded view of this situation. He is not an idealist in selecting one treatment as sufficing in all respects for carcinoma of the bladder and therein at least we agree. Dr. Carroll and I have that same view, as was expressed in Dr. Carroll's paper. We do

not look on any one treatment as being all sufficing, and I have had discussions with Dr. Budd Corbus of Chicago, on that point; I have taken issue with him, although I agree with him in many other respects, and also with Dr. Ballenger who relies altogether on radium. I don't think his point of view is the correct one. In fact, I think anyone who relies on any one mode of treatment to meet all the requirements of carcinoma of the bladder or any of these urinary organs is bound to be wrong no matter on which method he places all of his reliance. I think the conservative and the intelligent stand is to avail one's self of the benefits of any method of treatment that is available. In that light, I place surgical resection, surgical measures, fulguration and diathermy, radium and deep x-ray therapy. I think it is our job as intelligent practitioners of this work to be selective and to see which are the appropriate ones for individual cases.

As a matter of fact, I think general surgery is being limited more and more in its application all the time in bladder carcinoma. I think there is only one application for surgical resection and that is if the carcinoma happens to be located up in the dome of the bladder or the lateral walls away from the base or neck of the bladder. In that case there may be some reason for applying the surgical resection, although I don't place much confidence in that. I would rather place my reliance on the open operation, diathermy, fulguration and diathermy, followed by the use of radium a few weeks later, if it is found desirable. We are in entire accord with Dr. Nelson in generalizing to this extent.

We often use fulguration and diathermy first, and I will say that we agree with Dr. Nelson that although we formerly used these measures through the cystoscope, we have gotten away from that and now insist on open operation through the suprapubic opening. Any time the tumor is of any size or of any infiltrating tendency, we make use of the open operation all the way, rather than half way. Then we hold it open, I mean with a big suprapubic tube, and later on, according to the requirements of that individual case, we apply radium. In that case, we can use this same opening which we have maintained for the needles of radium that are removable, or we can put them in and let them stay permanently. All of that we can do according to our election at that time.

You have seen some of our results. We have probably about twelve or fifteen cases who have experienced difficult recovery, lasting quite a long time, the oldest being a man named Graferty, whom Dr. Carroll didn't mention and did not show, on whom we operated as far back as 1919. That was eleven years ago. That man had a carcinoma. He had been reduced in weight forty pounds and was getting up a dozen times at night to urinate. He had an infected urine and all the pains of carcinoma, and from every standpoint he was in a deplorable condition. The last six or seven years that man has been as healthy as any man in this room so far as his

bladder and urinary condition is concerned. He comes to us about once a year for an examination and we have found his bladder as entirely clean as he is free from symptoms. He doesn't get up once in the night to urinate and has no undue frequency in the day time. He is strong and healthy and has added again all the forty pounds to his weight.

The lesson of all this to me is that here are some individual cases that are apparently cured. What is going to take place next month or next year or ten years from now, you and I cannot state; but we have the evidence of the precision of recovery. A man may get a broken arm, he may get a recurrence of his carcinoma or what not—we can't predict anything about the future. But could we have said that, could we have demonstrated these patients that have recovered from carcinoma of the bladder before you ten, fifteen or twenty years ago? No.

So the lesson is that there has been material progress in this situation and we are extremely gratified that there is, because we don't have to hold up our hands in holy horror and say, "My God! we can't do anything," when we find a carcinoma of the bladder. We enter on the plan with a great deal of confidence now, unless the case is extremely advanced.

With respect to this indication for deeper x-ray therapy, we have not found good results from it in connection with the carcinoma of the bladder. I know Dr. Pfahler and Dr. Sante and others have a right to express a contrary opinion. I am only talking about our own experience. However, when it comes to sarcoma of the prostate or sarcomatous tumors, that is an entirely different situation. I have seen cases under x-ray therapy where the tumors have dissolved and gotten well as if by magic. In sarcomatous growths, therefore, I would place more confidence in deep x-ray than I would in these other measures, at least I would try it out first and then if I found it necessary, I would use radium implantations or some of those other measures. So you have different indications for different measures of treatment according to individual cases, and that is where specialism takes its place.

A few words with respect, to Dr. Frischer's contribution. I always have an open mind on these things. When a man tells me a thing I don't believe, I say, "Well, I am going to wait and reserve judgment until I see how it turns out."

There are several enthusiasts in this line of work. Dr. John Caulk, my friend, is a very plausible enthusiast and says he can cure these cases of hypertrophy of the prostate by means of the cautery punch. I don't deny he can, but I am not placing very much confidence in it unless he proves it for a longer time than it has been done.

Twelve or fifteen years ago I started the "ball rolling" on this subject by using through a cystoscope a little platinum-iridium knife with which I made an incision deep into the prostatic

contractures. I never had any confidence in it. I never tried to cure or relieve prostatic hypertrophy, because I think the proper thing, if you have a great big hypertrophied prostate, is not to fiddle along with punctures here and there or any of these lesser measures, but to take out the prostate and you will be rewarded by a recovered case. There are strong indictments made on prostatectomy by Dr. Frischer. I don't sympathize with him. I think if you put them through the preparatory treatment, if you open the bladder under local anesthesia, then when they have recovered from that, after drainage, and the excretion of thalein is raised from 10 per cent up to 40 per cent, and you reduce the non-protein nitrogen from 75 milligrams down to 35, you have adjusted your patient so he can go through a prostatectomy smoothly and comfortably. You put him through the first stage under local anesthesia and the second, under spinal anesthesia. You have a comfortable patient throughout and you have a recovered patient who is well in a month and you don't fiddle along with him six months or a year. You do not do the thing in the office.

If I understood this measure of Dr. Frischer's, I certainly would not undertake it in the office. I don't look at those things in such a casual, frivolous way. Dr. John Caulk does his work in the office. I wouldn't do it myself. I have done the same operation, both Young's and Caulk's, but I wouldn't under any circumstances do that in the office. I think it is deserving of much more respect. Every patient who comes in your hands should be given the best and nothing half way. However, I won't enter into a contest with Dr. Frischer. I just say I will wait for a few years and see how his results turn out and learn more about them.

I acknowledge, and with pleasure, the receipt of the information Dr. Frischer has given us, and I will watch him with a watchful waiting attitude.

Dr. M. T. Tood (Norfolk, Va.): I wanted to ask Dr. Carroll if those three cases he showed us were treated only with the diathermy or whether they also had some radium afterwards.

The next question I wanted to ask is this: Is it frequently necessary or only very rarely necessary to transplant the ureters in cases of carcinoma of the bladder?

The third question is this, with the same treatment, that is fulguration, would it be apt to be suitable for carcinoma of the prostate?

Dr. Roy W. Fouts (Omaha, Neb.): With reference to deep x-ray therapy in connection with the treatment of a malignancy of the prostate or of the bladder, I believe if the optimum results are to be obtained or expected, x-ray therapy should precede any attempts at surgery, be that surgical diathermy or whatever else. It happens very frequently that cases are referred to the radiologist for x-ray or radium, as the case may be, after much surgical manipulation. In other words, the damage of over-manipulation will favor metastases or the spreading of

the malignancy and will act as a definite barrier for the beneficial effects that can be otherwise obtained from the proper administration of x-ray or radium.

I believe if the diagnosis can be proven beyond a question of a doubt, if you are reasonably sure you have a malignancy of the bladder or prostate to deal with, before any attempt is made to introduce any of the recognized surgical procedures, be it diathermy, scalpel, surgery, we should first use radiation. Credit must be given to the modern urologist for the innovation of surgical diathermy and the electrotome scalpel into urology. They have been pioneers in this field of the newer surgery. However, if we are to expect the best results from radiation, I believe that they should be radiated prior to surgical intervention. It is a measure of insuring against malignant recurrences, so often seen shortly after operations even in the most competent hands.

Very often the prognosis of many of these cases is hopeless from the very beginning but in persistence we have often gained unexpected victories. I believe more can be expected from a procedure that contemplates pre-operative radiation, followed by suprapubic diathermization than by any other measure known to modern science.

In regard to such accidents as burns and even experiences of a more serious nature, these must be accepted as a part of the penalty of pioneering in a new field. Seldom, however, have the same experiences occurred to the same investigator. One usually discovers the fault of the technic soon afterwards, for the lesson has such a spectacular quality that it is indelibly imprinted upon one's memory.

Dr. F. L. Nelson (Ottumwa, Iowa), closing: Mr. Chairman, I am very pleased that we are so in accord on our surgical diathermy in bladder work with such distinguished authorities as Dr. Lewis and Dr. Carroll. Our work runs very nearly parallel.

I am very much impressed with the work of Dr. Frischer, although I don't know anything about it. Being a urological surgeon, my work in that line has been purely surgical. I will say this, and it has been brought out by Dr. Lewis, if these patients are properly prepared, given the proper amount of fluids beforehand, the bladder suprapubically washed out for ten days or two or three weeks, the bladder put in good condition and that patient brought up to normal condition and the kidneys tested out by the thalein test and the regular routine that the urological surgeons go through, the mortality on all prostatic work will be less than 10 per cent. I am open to conviction in regard to the methods of Dr. Frischer and I am willing to say I am very much impressed, and I shall be very pleased to follow his work and anyone doing that line of work. So far our work has been entirely and purely surgical.

On the line of bladder work, surgical diathermy gives a very much nicer bladder for working

purposes than does resection, for instance. You have an open bladder that is well rounded; while in dissection or excision, you will very often have an hour glass bladder that will be more or less of a diverticula where the urine will locate and you will have a residual urine that will make an infected bladder following the operative procedure. That, I feel, is a very important point. We do not get that in our surgical diathermy.

Dr. Fouts' discussion brings up again the same old angle I spoke about in the beginning, that we do not have a clear conception as to the correlated ideas of treatment. There should be someone, a commission appointed to get the up-to-date data through the larger clinics and personal experiences and contacts, and so on, to try to bring this type of work down to a definite concept. Personally, I do not believe in x-ray treatment before the operation; I do believe in it afterwards. I have seen several cases of what were supposed to be inoperable carcinomas that were fulgurated out, that were followed by deep x-ray therapy; at least four or five of those cases are still well. That has been now two, three, or four years. They are still well whereas in the beginning they looked absolutely inoperable, hopeless.

I do not feel that x-ray is a thing to be depended upon. I do not believe you can give any patient a sufficient dose of x-ray to destroy a carcinoma of the bladder before anything is done to it. I want that very strongly emphasized. I do deep x-ray work and I do not deem it should be beforehand.

I simply continue to state that if I myself had that trouble, I should want my bladder opened; I should want it carefully inspected. I should want it fulgurated, and if the condition was serious, I should want radium implanted following it.

Dr. Grayson Carroll (St. Louis, Mo.), closing: Briefly, I wish to express my appreciation for the discussion of the paper. In reply to the questions asked, we did not use radium in the three cases presented. One case I spoke of, we did use radium through the cystoscope but I deliberately picked out those cases who had been treated strictly by diathermy. So that these recoveries presented here are strictly the results of diathermy.

We have done very little in the line of carcinomatous prostates in the way of diathermy. I recall one case that we used diathermy on and later used radium on—Mr. Burnett Hughes. For three years he remained satisfactory and then returned to us recently with a prostate that was as hard and as large as previously when we treated him. We have inserted radium into that prostate and he has returned home. When he returned home twelve days after the insertion of radium, it had been reduced in size definitely. The residual urine had been decreased. We have not had sufficient experience to speak with authority on diathermy in carcinomatous prostates. We have not found it necessary at any time to use

the urethral transplants. It is surprising and we don't realize just exactly why that is true because there certainly are adjacent and overhanging ureteral orifices at times.

Dr. Julius Frischer (Kansas City, Mo.), closing: Everybody has been confessing their difficulties. I shall relate some of mine. One was a case of a urologist in Kansas City who was performing an electrocoagulation on a patient. He had a very competent anesthetist administering ether anesthesia. The ether cone caught fire and the patient was burned to death.

Another (Dr. Lewis knows of the case), was a man named Sasse, of Brunswick, Mo. I operated him. I removed his prostate seventeen years ago. He came to this city while I was in Europe, in 1920 and 1921, and Dr. Lewis took care of him at that time. He had an obstruction due to a recurrence of the carcinoma in the region of the prostate. He was informed at the time that he had a regrowth on the prostate. He was recommended by someone to a roentgenologist in St. Louis. That man following radiation therapy developed a definite burn from the roentgenological treatment. I was called down there when I got back from my trip. Of course, that wasn't Dr. Lewis' fault; it was due no doubt, to inefficient roentgenological work.

I am as yet not convinced just as I said yesterday in regard to carcinomatous conditions, and especially carcinoma in the bladder—when the deeper structures are involved, of the efficiency of x-ray therapy. I am convinced that patients with small papillomas or small projectile growths can be handled more effectively through the cystoscope and should be handled that way; and that when the cystoscopist cannot manage it that way any longer, he should be opened in spite of the danger of metastasis. To that extent I am in accord with the other essayists on this symposium.

I remember one case especially. An old man came to us a number of years ago. I burned out his growth and I thought I did a very, very good job of it. Five years later he came back and I again coagulated the part through the cystoscope. Two years later he came back and I could feel per rectum a large indurated area about three inches long, I should say, by about an inch and a half in width. I did a complete bladder resection, leaving an area of about three-quarters of an inch surrounding the trigone. One ureter was implanted into the side of the bladder and the other ureter was not disturbed. That man lived six months with metastasis taking place in other parts of his body, and he died.

I am still of the opinion that a bladder growth is a dangerous thing. I am a pessimist as to the end results in these cases. The results of Dr. Lewis and Dr. Carroll are splendid demonstrations that more than one line of procedure may be followed. Only the future and the tolerance of the profession will eventually decide which is the best.

THE PRESENT STATUS OF THE ELECTROCOAGULATION OF TONSILS

FRANK J. NOVAK, JR., M.D.

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In a report published in 1923⁽¹⁾ attention was called to the fact that the electrocoagulation of tonsils in the manner advocated at that time was not unattended by the danger of violent reaction, great pain, dyspnea, excessive cicatrization, and distortion of the palatal arch. There has since been, however, a rapid development of the technic, so that at the present time these reactions are reduced to a minimum. The report of a case in 1928⁽²⁾ demonstrated the possibility of sealing over a focus of infected tonsil with smooth scar by means of surgical diathermy. It was pointed out that such a situation precluded the possibility of discovering a concealed remnant of diseased tonsil with disastrous consequences to the patient. On numerous occasions the writer has questioned the rationale of the procedure. It is difficult to understand how an operator can estimate the depth to which the coagulation extends. It is an obvious fallacy that the tonsil capsule presents an effective barrier to the coagulating process. Even a casual inspection of the anatomic structure of the so-called tonsil capsule makes this point clear. Moreover, there is always imminent danger of permanently damaging the palatoglossus and the palatopharyngeus muscles because of the relative intractability of the current within the tissues. That these are valid facts and not mere theoretical speculations is amply supported by numerous clinical observations.

The writer has believed for many years that the promotion of this method of tonsil removal was a misguided effort. It was hinted that the enthusiastic pioneers were imposed upon by rapacious manufacturers more intent upon monetary gain than upon scientific progress. However that may be, it is a matter of importance, nevertheless, that some men of good judgment and sound clinical training are advocating electrosurgery. Furthermore, an increasing number of patients demand the removal of their tonsils by "electricity."

A manufacturer of diathermy apparatus recently conducted a three-day class of instruction in the technic of tonsil coagulation. The

attendance at this meeting in point of numbers would have done credit to a state meeting. It is obvious that there is an acute interest in the subject not only on the part of the medical profession but also on the part of the general public. Whether this is the result of intensive and well directed propaganda is entirely beside the point. It is a suitable time for an unbiased estimate of the situation, and it is hope of the writer to make such an appraisal.

In seeking for a new method for the removal of tonsils it is well to pause and ask the question, "what is wrong with the old method?" By "old method" we mean the removal by dissection and the use of a snare, or the use of some form of a tonsillectome. The difficulties of the operation may be classified in the following manner:

1. Hemorrhage (primary).
2. Pain or great discomfort.
3. Difficulty in the enucleation, due to previous peritonsillar abscess or chronic peritonsillitis or to:
 - a. Malposition of the styloid process, or
 - b. Calcareous or cartilaginous inclusions within the tonsil.
4. Complications:
 - a. Secondary hemorrhage.
 - b. Trauma to pillars.
 - c. Inadvertant uvulectomy.
 - d. Distortion and immobilization of the soft palate.
 - e. Lung abscess.
5. Economic considerations:
 - a. Expense of hospitalization.
 - b. Relatively long period of disability.

It is probable that no clinician of experience will deny the validity of the drawbacks of tonsillectomy as listed above. He may question whether the fault lies invariably in the method, or whether the element of skill, adequate training, knowledge on the part of the operator does not play an important rôle. It is a notorious fact that there are medical men who claim no surgical qualifications whatever, yet who do not hesitate to DO a tonsillectomy.

The incidence of hemorrhage does not lie within the control of the operator. The pain and discomfort of the patient during operation is readily reduced to a minimum by proper and adequate local anesthesia. Excepting the unusual case, the inability to enucleate successfully is usually due to the ineptitude of the operator. While the accident of uvulectomy, palatal trauma, and the distortion of the palatal arch may occur to the most experienced and skilled surgeon, it more frequently bespeaks faulty technic. The incidence of lung abscess is a matter of grave importance. In a general way the following factors are involved in the production of lung abscess. A previous attack of influenza wherein the ciliar apparatus of the upper respiratory tract epithelium has been damaged, predisposes to pulmonary abscess. When under this condition aspiration of purulent secretion and blood takes place, abscess formation may be looked for. Adequate illumination of the operative field and proper management of the suction apparatus reduce the danger of this complication to a minimum.

Prolonged painful deglutition, loss of bodily weight during convalescence, expense of hospitalization, and a relatively long period of disability are drawbacks inherent in the method. If we sum up the situation we find that some of these drawbacks and difficulties may be charged at least in some measure to the operator. An important residue, however, remains. Hemorrhage, primary and secondary, is unpredictable, and occurs frequently. Lung abscess occurs. The patient suffers pain.

With these facts in mind it is not at all remarkable that medical men have cast about for a new method, superior to the classical one. Let us examine the claims made for electrocoagulation of the tonsils and judge of their validity. Such an appraisal presupposes both a theoretical and a practical clinical knowledge of the subject on the part of the one undertaking such an enterprise. The matter has engaged the attention of the writer for many years.

What then are the merits of surgical diathermy in tonsil work, and in what manner is this method superior to surgical tonsillectomy?

Its proponents claim that it is a bloodless operation. Secondary hemorrhage does not occur. Let us cite a case in point.

On November 5th, 1930, Mr. C., aged 40, was admitted to the Lake View Hospital with a severe hemorrhage from the throat. Three days previously he had had an electrocoagulation of the left tonsil. The bleeding persisted intermittently for forty-eight hours. It was found that he had a marked diminution in the number of blood platelets. He had chosen electrocoagulation because he had been told that it was a bloodless operation.

It is claimed that it is a painless method. Mr. W., age 50, was admitted to the same hospital on March 15th, 1930, with a cellulitis of the neck extending from a line from the tip of the chin to the mastoid tip to a line from the sternal notch to the tip of the shoulder on the left side. He had had a coagulation of the left tonsil five days previous. Respiration and deglutition were difficult. Pulse, 120; temperature, 103. He suffered extreme pain. He remained in the hospital four weeks.

Despite all of this the method has the great advantage that it is an office procedure, and as such is adaptable to a type of patient encountered in practice more or less frequently. This type of patient has a morbid fear of operation and will not submit to one. Where the tonsils must be removed such a patient will usually undergo tonsil coagulation willingly. Again, hospitalization and even a short period of disability may mean economic disaster to a patient. He therefore decides that, come what may, tonsillectomy must be deferred indefinitely. Then there is a group of cases which for one or more of many reasons are considered as poor surgical risks. It is in this group that surgical diathermy or desiccation is pre-eminently the operation of choice. There is no other recourse. The cautery is altogether unsatisfactory, and radium and x-ray are relatively inefficient procedures compared with diathermy. The use of local measures such as suction or the application of various solutions is certainly a futile gesture. Therefore, one must look upon the development of this method of destroying tonsil tissue as a useful addition to the surgical resources of the laryngologist.

After a complete tonsillectomy a pharyngeal lymphoid hyperplasia occurs not infrequently. These lymphoid excrescences are found in the tonsil fossae, at the margins of the pillars and at the base of the fossae. They

are subject to inflammatory changes and give rise to mild symptoms of sore throat. They are difficult to remove without causing considerable trauma. It is possible to destroy these lymphoid masses with electrodesiccation. The mono-terminal current is used. The needle is introduced superficially into the follicle which is subjected to a momentary action of the current. The patient experiences practically no discomfort whatever. Within a period of four or five days the fossa is found to be perfectly clean.

Following tonsillectomy many cases are found with masses of lymphoid tissue at the base of the fossae. It is possible to destroy this tissue by electrodesiccation. The technic is not difficult, and the patient experiences very slight reaction. This tissue is usually extracapsular lymphoid tissue, and, strictly speaking, should not be regarded as true palatine tonsillar remnant.

The writer has been charged with maintaining an unreasonable opposition to the practice of electrocoagulation of tonsils. This antagonism has been directed toward the altogether unwarranted advocacy of this method by uncritical enthusiasts. There is nothing in the clinical experience of the writer, or observed in the clinical results of others to justify the endorsement of this method in preference to the classical operation, *except in certain selected cases*.

There has been an undue emphasis placed upon the ease of acquiring the technic of electrosurgery of the tonsil. This has led to a fatuous sense of security on the part of the occasional tonsillectomist. A method which is heralded as bloodless, painless, as presenting no technical difficulties, as being devoid of serious complications, naturally has appealed to the untaught and the unskilled. The writer has, therefore, on many occasions called attention to the complications which may occur following electrocoagulation of the tonsils, and to point out that although it is electrosurgery, it is essentially surgery and that as such, preparation for it calls for study and apprenticeship in much the same way as does any other type of operative work.

In general it may be said that although surgical removal of the tonsil is not an ideal technic in that there are inherent in its procedure difficulties and complications, it is at present the best available technic. The removal of tonsils by diathermy is not devoid of risks, the proper technic is not easy to learn nor is it always easy to carry out. A properly executed surgical tonsillectomy is a neat, swift, complete, workman-like job in the ordinary case. Under similar conditions diathermic destruction is slower, lacking in the sure precision and control characteristic of good surgery, and there is always the unpredictable factor of the depth of penetration of heating current. It is generally held that the best technic is that in which only one tonsil is treated at one sitting. It requires from three to five sittings to complete the destruction of one tonsil. This requires from two to three weeks time. This conservative technic is far safer than the more rapid and, therefore, more radical method. It may then be said that because of imperative economic necessity electrocoagulation of the tonsil in some patients is a necessity. In cases of poor operative risk it is the operation of choice. For the destruction of small post-operative remnants of tonsil tissue there is no better method than electrodesiccation.

Conclusions

1. In the opinion of the writer electrocoagulation of the tonsils is not a method superior to surgical removal.
2. It is a valuable adjunct among the procedures available to the tonsillectomist.
3. The progressive otolaryngologist instead of regarding it as a negligible novelty will use it in properly selected cases.

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HYPERTENSION *

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In far too many instances the first consideration in the treatment of hypertension is the application of autocondensation. While autocondensation is a very valuable agent and should not be overlooked, it should never be one's only ally. It is well to remember that we are physicians first and physical therapists second. When a patient with symptoms of hypertension presents himself for treatment, the first thought should be, as in every other condition—what of the etiological factors. The patient should be given a thorough examination, leaving no possible causes uninvestigated. After the examination has been made, the treatment should be gauged accordingly.

In the examination, the following factors should ever be kept in mind: the type of life led by the patient, whether the diet was at fault, use of stimulants, infection and toxemia.

The average American travels at such a rapid pace that his life is one of tension, which tends to stimulate the nervous system and possibly the adrenals, and acts as a factor in the production of hypertension. While this high tension life, in and of itself, may not cause hypertension, it is only a part of the many factors that enter into the responsibility for the condition.

Faulty diet also is one of the causes of hypertension. Any diet that will leave an acid ash, tends to produce changes in both the kidneys and blood vessel walls. Diet that leaves an alkaline or basic ash does not produce the changes mentioned, and has a tendency to correct them when existing. Meats, eggs and cereals are acid producers, and fruits, vegetables, with the legumes, especially lima beans, are alkaline producers. Again, a diet too heavily laden with animal protein usually leaves a residue which aids in putrefaction in the large bowel, which will be discussed a little later.

Alcoholic beverages of all kinds should be avoided, with tea and coffee used in moderation, if at all.

Infection plays an important rôle in the causative factors of hypertension. The teeth, tonsils, in fact, all sources where infection is liable to lurk, should be investigated and thoroughly treated if necessary. A Wassermann test should always be included as a part of the examination. Its importance is so well appreciated that it need not be discussed at this time. In far too many instances hypertension will still exist in spite of the effort to correct such pathologies as have been mentioned above.

Toxemias of bowel origin will next bear investigation and in many instances should receive our first consideration. That the large bowel is nothing but a cesspool cannot be denied, but there is some controversy as to whether a normal bowel wall has selective action in absorption. If for the sake of argument this supposition is taken for granted, namely, that it is able to protect a normal person against intestinal toxins, what about those with abnormal bowels?

Step into an x-ray laboratory and see pictures of the colon taken of patients suffering with hypertension and see how many normal bowels you will find! Where you will find one normal bowel you will find at least ten with dilated, prolapsed, redundant walls, with incompetent ileocecal valves. These bowels certainly cannot have selective action. Poisons are absorbed and toxemia with hypertension in many instances is a direct result. Just in what way the toxic substances are able to produce hypertension cannot be definitely stated, but in all probability, the toxin directly stimulates the heart, or contracts the blood vessels, or stimulates the action of the suprarenals, or it may have a depressing action on one of the liver functions whose province is to control blood pressure.

From a treatment standpoint the cases of hypertension can be divided into three groups.

1. Cases which respond to correction of diet and change in life habits.
2. Cases which require treatment in addition to the above to effect a cure.

* Read at the Ninth Annual Meeting, American Congress of Physical Therapy, St. Louis, September 12, 1930.

3. Cases in which no lasting results can be obtained.

Group One represents very early cases in which there is only a systolic rise, the diastolic remaining normal, and in which there is no structural change in the tissues. They usually respond to correction of the diet and radical changes in the life habits. All habits which have contributed to the cause must be changed regardless of the struggle. All heart stimulants and toxic substances should be discarded. Tea, coffee, alcohol in any form, and tobacco should be forbidden. Flesh foods of every description should be reduced to a minimum, and in some cases discarded altogether. Gluttony should be emphatically discouraged. All high life, late hours, irregular meals, and business tension should be abandoned.

Group Two. If the suggestions outlined under "Group One" have failed, then one should look for focal infection. The teeth, tonsils, and all other sources should be investigated and all infection removed if possible. If these fail to give relief, then the colon should receive our attention, and in many instances should receive our first attention. Many times the infection was primarily in the mouth but established itself as a secondary focus in the colon, and even though the teeth and tonsils are cared for it would have no influence upon the secondary source. In addition to the infection that was transplanted into the bowel, we have toxins that are constantly being absorbed from the colon, which in many instances are the direct responsible factor of hypertension.

In order to relieve high blood pressure of toxic origin, it is necessary to thoroughly cleanse the colon with high colon irrigations and change the intestinal flora by the use of the bacillus acidophilus in some one or more of the culture media.

After all this is accomplished, if the pressure still remains, autocondensation and biologic rays of ultraviolet are the two agencies that we must depend upon for relief. They both are detoxicants and assist in destroying the toxemia. Autocondensation in addition to its ability to destroy poison has some action upon the cells of the body which is not defin-

itely understood. There is a positive stimulation of excretion which in many cases lowers blood pressure in a very satisfactory way. The author has great faith in autocondensation and ultraviolet in the relief of hypertension, but his faith is not so strong as to ignore a dilated bowel, abscessed teeth and tonsils, syphilitic conditions, and wrong habits of diet and living. These must be corrected if you expect lasting results to come from your autocondensation and ultraviolet.

Group Three. In Group Three we have a series of cases which cannot be cured regardless of our line of treatment; in fact, in some instances autocondensation actually makes these patients worse. The majority of them can only be temporarily relieved by the use of autocondensation. Some physicians have said that because these cases can not be cured, it is useless to waste the time trying simply to relieve them. But this type of logic is faulty. If only temporary relief can be obtained, it is well worth the time. The inevitable apoplectic stroke can often be postponed and the patient given a few more years of usefulness. It is very similar to the administration of insulin in diabetes. Nobody expects a cure, but it does offer the incurable patients an opportunity for a longer life of usefulness. And just like insulin in diabetes, so autocondensation in hypertension.

The chief causes of failures in treatment may be summarized as follows:

1. Wrong diagnosis as to group.
2. Lack of co-operation on part of patient.
3. Inefficient apparatus.
4. Lack of knowledge of the fundamental principles of ultraviolet and the high frequency current resulting in bad technique.
5. Lack of patience and perseverance in the chronic cases.

If results are to be obtained in the relief of hypertension, it is necessary to have the full co-operation of the patient, because in most instances the success of the treatment depends on the combined efforts of both. But with the full co-operation of the patient and proper treatment on the part of the physician, many cases may be saved which ultimately would have led to paralysis and untimely death.

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E D I T O R I A L S

SUNLIGHT AND CALCIUM METABOLISM

Heliotherapy and actinotherapy have been employed in medicine long before any knowledge of its action on the biologic organism was available. With progress in science empiricism finally gives way to knowledge and to the application thereof on a basis of experimental evidence. Levine⁽¹⁾ points out in an article published elsewhere in this issue that such evidence has recently been brought forward leading to a scientific explanation of at least some of the effects of ultraviolet rays on the biologic organism. The most definite facts ascertained concern the relation of the ultraviolet rays of the sun to mineral metabolism. At the present state of our knowledge, he asserts, we know of no specific action of sunlight or of ultraviolet rays on the physiological processes of man except the calcium-absorbing influence through the gastro-intestinal tract and the calcifying influence on ossifying cartilage of a circumscribed band of rays—that is, rays with a wave length of about 300 millimicrons. So definite and precise is the biologic function of these rays, that their presence can be determined by their

anti-rachitic effects as accurately as by direct physical measurement.

It is interesting from a historical point of view that the study of the biologic properties of sunlight and of ultraviolet gained impetus through the channels of experimental nutrition. For a very long time cod liver oil completely dominated the therapeutic situation in rickets. Schabad⁽²⁾ in his classical studies in 1909 and 1910 first demonstrated the specific effect of cod liver oil on calcium and phosphorus metabolism. He reported the retention of these elements as a result of the addition of cod liver oil to the diet of a rachitic infant. In 1919 Huldsky⁽³⁾ observed that ultraviolet rays exerted a curative influence on rickets, and in 1920 he demonstrated the cure of tetany by the same means. In 1921 Hess and Unger⁽⁴⁾ were the first to announce as the result of roentgenological evidence that sunlight possesses the same therapeutic action in human rickets as the light of the mercury vapor quartz lamp. Hess and his co-workers also reported in the same year the prevention of rickets by exposure to ordinary sunlight.

Racynski,⁽⁵⁾ in 1912, was the first to furnish proof of the favorable influence of light on

calcium metabolism. He permitted one puppy to live in the dark while another lived in the open, exposed to sunlight. At the end of six weeks the experiment was ended. On analysis the body of the young animal kept in darkness yielded very much less calcium and phosphorus than the body of the one allowed access to sunlight. Since then many investigators have observed and reported upon the favorable influence of sunlight and of ultraviolet rays on calcium absorption and calcium retention. We now accept beyond doubt the fact that sunlight or the ultraviolet ray plays a very significant part in calcium metabolism in general, and specifically in the process of calcification. Sunlight through its ultraviolet rays insures the most efficient biologic use of calcium.

As yet we do not know exactly how this efficient use is accomplished. Many able investigators are now engaged on the important problem of calcification. Since the discovery of the close relation of ultraviolet to calcium metabolism we have gained a better knowledge of the reason for the effectiveness of cod liver oil. We have also discovered that irradiation of food imparted to them biologic properties characteristic of cod liver oil or of ultraviolet. We have isolated the substance in cod liver oil and in many foods that acquire anti-rachitic properties after irradiation. This substance is ergosterol.

We may state at present that ergosterol is a sterol or solid alcohol occurring widely distributed in biologic fat mixtures. The skin acquires anti-rachitic properties because of the presence therein of ergosterol. The skin ergosterol when activated by sunlight enters into circulation and produces internal changes ascribed to ultraviolet rays.

With reference to calcium metabolism we recognize two local factors. No doubt there are also systemic factors. Sunlight or ultraviolet increases gastric acidity. The increased quantity of gastric acid finally reaches the small intestine and renders its contents acid. An acidified duodenal content is necessary for the absorption of calcium compounds, since they are apt to precipitate out in alkaline medium and pass out unused. The gastro-intestinal tract must be regarded as a local factor that enters into the problem of calcium assimilation, for absorption is a prerequisite to subsequent retention and final assimilation.

The use of calcium salts in the pre-operative stage in the hopes of raising the calcium content of blood to increase coagulability is a practice that is carried out unwisely. These salts may not be absorbed when there is a tendency to low gastric acidity or to an acidity. Such tendency exists in states of under-nutrition and malnutrition and also in the presence of infection. In order to be sure of calcium absorption we must do one of three things. We may prescribe with the calcium salt, acid, like hydrochloric acid, lactic acid, citric acid or lemon juice, or acidified food, such as lactic acid milk. We may prescribe calcium salts to be taken simultaneously with cod liver oil or irradiated ergosterol. We may prescribe calcium salts together with ultraviolet treatment.

So far as calcification is concerned we must recognize still another local factor operating in the epiphyseal zone of calcification. There we find an enzyme, an esterase, capable of hydrolyzing a phosphoric ester present in the cell components of the blood and liberating the phosphate necessary in the formation of the calcium phosphate laid down in bone. Changes in hydrogen ion concentration in the calcifying zone in the bone and in the blood stream no doubt plays a significant part as well as changes in the colloidal substrata and changes in the permeability of blood corpuscles and of the capillaries and cells in ossifying cartilage.

Among other interesting facts with relation to local conditions in the zone of calcification we may mention the findings of Shipley⁽⁶⁾ and of Bosányi⁽⁷⁾. Shipley and others have shown that calcification goes on *in vitro*, provided the bone is placed in a solution containing the salts necessary for bone formation and maintaining proper conditions with reference to hydrogen ion concentration. Rachitic bone when placed in the calcifying solution also continues in the process of ossification. Evidently we must reckon in rickets with a systemic factor which hinders local calcification. Bosányi has reported the presence in normal bone of an anti-rachitic substance, which is absent in rachitic bone. It is water-soluble and can be extracted from the spongia and from the bone marrow.

We have clearly established in the last decade or two the existence of a group of diseases caused by lack of an essential dietary factor in the food intake. We call these

deficiency diseases. We can now truly point to sun-deficient diseases. These are rickets, osteomalacia and tetany. These diseases have come to us as a result of custom or as a result of a changing mode of living. Clinically they are all marked by disturbance in calcium metabolism. They all display a seasonal variation. They show a greater incidence and a greater severity in symptoms in the months of the year which are most deficient in sunlight and consequently in ultraviolet radiation.

In each disease mentioned the disturbance in calcium metabolism seems to be most marked in one direction. The most conspicuous fact, Levine points out, in regard to rickets is failure of calcification of the bony structures of the body. In regard to osteomalacia it is decalcification of the bones accompanied by marked loss of calcium through the excretory channels. In regard to tetany it is a deficiency in the calcium ions present in the blood. It must be remembered in this connection that tetany is a frequent complication of both rickets and osteomalacia. All these diseases are cured or prevented by sunlight or ultraviolet rays, when the calcium and phosphorus intake is adequate.

It is to be hoped that a study of calcium absorption and calcium assimilation will be pushed vigorously. Correct information in this field will do much to add to our knowledge of the biologic mode of action of sunlight and ultraviolet, and will put heliotherapy and actinotherapy on a better scientific basis. It will also be a great aid in treatment and prevention, for calcium and sunlight are vitally concerned in the problem of immunity and in the ability to diminish susceptibility to infection.

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THE FUTURE OF PHYSICAL THERAPY AS A SPECIALTY

Concurrent with the present recognition accorded to physical therapy by the various medical universities and by the profession in general, many of its devotees are now speculating, apprehensively or otherwise, regarding its future as a specialty. Although no authoritative answer can be offered by anyone at this moment in regard to its future, a rational prognostication can be advanced if we but survey the situation from a safe perspective. It is well to remember that the progress in medicine, in spite of inherent conservatism, or petty prejudices or periods of enthusiasms has always managed to reach a sane level of impersonal evaluation, during which its accomplishments and its fallacies have received the recognition it justly deserved. Premature condemnation of what is now recognized as fundamental in our concept of medicine has been the experience of more than one pioneer. Transitional periods in medicine have been known to follow important contributions, at a time when the majority of the profession were least prepared to change their point of view. It is our inherent conservatism that makes us cautious to new innovations. But it must also be remembered that false prophets have more than once whispered alluring pictures of a new promised therapy, and their followers have in the end found themselves confronted by a hopeless mirage.

The future of physical therapy as a specialty may in a sense be similar to the working order of the law of supply and demand. It presupposes that before a continuous demand can be created for this form of therapeutics as a specialty, those interested in its future must create the demand by supplying the scientific proof of its stability, even to the point where it becomes a habit to the profes-

sion and a by-word on the lips of the layman. Both must become physical therapy-minded: the first through the orthodox channels of current scientific literature, the latter through experience.

Much of this has already taken place. Together with the recognition of its place in medicine, the profession has paid it the uncommon compliment of adopting some of its measures as a part of its own practice. One can deduce from this a new attitude towards physical measures. For example, ultraviolet administration has become synonymous with pediatric practice, the general practitioner has gradually adopted physical agents with greater confidence and enthusiasm, the urologist and gynecologist have on several instances made overtures to employ it more extensively. In most instances the added weight of all their experiences has been productive of a greater appreciation for the new method.

The physician specializing in physical therapy need have no particular apprehension because of this existing situation. It is but the transitional stage in the evaluation of the specialty. Recently a similar situation was editorially discussed in the *British Journal of Radiology** in regard to the future fate of radiology as a specialty. It is of interest that Radiology at this period of its high status finds reasons to question its future status. It says in part:

In the earlier stages of its evolution its fate rests entirely with the medical profession. The pioneer in a new specialty is usually entirely dependent on the patronage of practitioners in other fields, and in such circumstances is apt to be regarded more or less patronizingly. He is expected to confine his activities within narrow bounds, even though his patrons, who may themselves be specialists, practice their art along much broader lines. The duration of this period of professional domination will depend on varying circumstances; but sooner or later, if the new specialty is to survive, it will enter upon a period of transition during which its fate passes beyond the determination of the profession as a whole, finally to become vested in the public. This readjustment takes place so gradually that the participants in it may not realize that it is occurring. Patients begin consulting the specialist on their own initiative. His colleagues in other fields will doubtless continue to refer patients to him, but with this added incentive, that the patient expects it, and in the ordinary course of events is likely to go to him anyhow. It ultimately transpires that the specialist finds himself referring about as many patients to other physicians as they refer to him. When such

a reciprocal relationship has been established the specialty may be said to have become stabilized, and thereafter its fortune will depend largely on the measure of public respect and esteem it may be able to command.

The destiny of physical therapy as a specialty depends on the present and future members in its ranks. Its place in medicine will to a great extent rest upon the quality of its scientific literary productiveness. Its future as a specialty will rest upon the respect and the high regard it will be able to create and awaken among its fellow practitioners. It is fortunate for physical therapy that many of its leaders have maintained a high status among their medical colleagues and have been associated in the new educational renaissance through faculty connections in the leading medical universities. With the background enumerated above the future of physical therapy is very hopeful.

Space as the Only Reality

Professor Albert Einstein is human as well as mathematical, and it is possible to suspect him of concealing a grin when he protests himself to be merely a mathematician and not a metaphysician. Certainly he has set our metaphysicians dancing to very exciting tunes, and the summary he gave of his great address to the World Power Conference in Berlin, is likely to increase the speed of their gyrations. Calling it indeed a metaphorical summary, he declared space to be sole representative of reality; it has eaten up light and gravitation, electro-magnetic fields, corpuscles and their movements. By space, doubtless, he meant the four-dimensional space-time continuum, and by eating up he meant that all we know of the universe, gravity, electricity, light, matter, can be included or deduced from a space-time continuum of such a kind that it is satisfied by certain simple (mathematically speaking) mathematical conditions.

Now mathematics, we may readily agree, are products, or states, or whatever one may choose to call them, of mind, and it will be an inference very agreeable to many philosophers that here is a leading man of science, possibly the leading man of the day, proclaiming idealism as the message of modern science, insisting that in the last resort the only reality is mind. The inference is worth examining. The conception of limitless space seems to most of us to be necessary, and many philosophers

* Editorial: The Future of Radiology as a Specialty, *Brit. Jour. Rad.*, 4:97 (March) 1931.

have declared it to be intuitive, a natural endowment of the human mind. Einstein rejects both the intuitive view and the conception that we can get the idea of a spacial continuum directly from our senses.

History of Space

According to Einstein, people must have begun with the notion we all have, that the external world is real and is full of material things. Some of these external objects are in contact and all have, or seem to have, relative positions. Measuring for practical purposes, such as building and marking plots of land, led to a primitive mathematics. The Greeks, of whom our old friend Euclid is the type, made an abstraction from reality by imagining such ideal things as the point, the straight line, the plane and linear extension, defining these by the well-known axioms—a point has position without magnitude, a straight line is the shortest distance between two points, and so forth. On this basis they were able to construct a rational system of deductive geometry, in which the conception of continuous space did not appear.

Descartes introduced a spacial continuum into mathematics, apparently because it seemed easier to have one body against which all other bodies could be measured, instead of comparing bodies only the one with respect to the other. His "space" was a pure abstraction, and except that it was empty, it was like a solid, extending infinitely in every direction. By the mathematical system of co-ordinates which he invented, it was possible to describe by a formula the position of any point, the path of any kind of line, straight or curved, and the configuration of any kind of shape with reference to axes of length, breadth, and depth.

It was to such a mathematically conceived universe, occupied by material bodies, that Newton fitted his laws of mechanics and his conception of gravitation and acceleration. If light could have been regarded, as Newton hoped to be able to regard it, as an emission of particles traveling from body to body through empty space, then the scheme of the universe might have been left as Descartes and Newton conceived it. But the wave theory of light required a vehicle (and so the æther was imagined and assigned the necessary theoretical qualities. But gravitation was left out, and had to be accepted as an unex-

plained phenomenon. Later came trouble with electro-magnetic fields; if the æther were given qualities, so to speak, to fit the theory of these, then it ceased to fit the Newtonian laws of mechanics.

Meantime mathematicians had been developing a logic in which there were not three but four dimensions of space, and exploring the theoretical properties of such a continuum. Then, as is now well known, by taking time as one of these four dimensions, Einstein was able to devise formulæ which brought gravitation into his fold, and now, he tells us, has also brought in electro-magnetic fields and possibly also particles. Not several different systems but a single mathematical conception of space-time fits all we know of the universe.

Back to "Reality"

But there is a reservation to be made, and probably Einstein had that in his mind when he said that he was a mathematician and not a metaphysician. You cannot take out of a mathematical mill more than you put into it, although the flour may be very different in its usefulness from the raw corn. And the grist brought to the mill at every stage of the long and magnificent history of physical science has been abstractions from what we call reality, in the crude every-day sense of the word. The point, the straight line, the plane, Descartes' space, Newtonian mechanics, fields of gravity and of electro-magnetism, the quantum, molecule, atom, electron, and so forth, are all theoretical conceptions, observations stripped of the crudeness of reality, and taken as pure symbols. They were mental conceptions from the beginning, and nothing but a mental conception can be deduced from them. It is to be noticed, moreover, that Einstein himself still relies on external reality. The standard of truth which he adopted for relativity was not the correctness of its mathematical deduction, but the circumstance that observations made on the light of a planet observed during an eclipse, and shifting of the lines of a spectrum under certain conditions confirmed his mathematics. And now he tells us that inferences from his new Unitary Field Law are standing the test of confrontation with the empirical, that is to say, observational laws of gravity and electricity.—(*The Times*, June 30, 1930.) *Ab. Brit. Jour. Radiol.*, Vol. III, No. 36:570, December (1930).

Discussion of De Walt and Carpenter's Papers *

(Continued)

Dr. L. E. Hinsie (New York): Since June, 1930, the New York State Psychiatric Institute and Hospital has had the pleasure of cooperating with the General Electric Works in the matter of fever therapy on certain types of mental disorders. This piece of work has been carried on with the aid of an apparatus called the radiotherm. For this purpose the General Electric Company has kindly provided us with one of these machines and has been helpful at all times as regards the technical management of the apparatus.

It is a well established fact that the most efficient form of pyrotherapy that we have today for the treatment of the parenchymatous types of neuro-syphilis is malaria. It is not known just how malaria brings about its favorable results. We were pleased to have the opportunity of trying another manner of raising the patient's temperature and we felt that if the same clinical results could be achieved with this machine that has been accomplished with malaria a better understanding of the underlying factors responsible for the clinical outcome might be had.

With radiothermy any desired temperature may be reached in the human being. As a preliminary to treatment by the radiothermis we gathered statistics on the optimum temperature curves that were witnessed in cases of general paralysis that had obtained full clinical remission. We have since tried to reproduce these optimum curves, but up to the present time we have had to be content with something less. This latter situation was necessary in view of the fact that exact temperature reproductions were not tolerated well by our patients. Just why this is so we are unable to ascertain. We see no reason why with an improvement in our knowledge such a reproduction cannot be achieved.

Dr. Carpenter, through his experimental work on rabbits, had already indicated that it was reasonable to try this form of treatment on human beings. In the selection of patients with general paralysis for this research work we were guided by the same principles that guide us in the selection of patients for malarial therapy. All of these preliminary features tended to make our series uniform and to make the group treated by radiothermy good control material as compared with those treated by malaria.

Owing to the nature of general paralysis and its response to various therapeutic agents, it is highly essential that before any reports are rendered as regards the clinical outcome there should be a sufficiently large number of patients.

* This discussion was inadvertently omitted from March 1931 issue for which the editor begs the indulgence of the reader.

Moreover, a period of at least six months should elapse before any report is made. We have not yet met either of these requirements and are, therefore, not in a position to give any statement as to clinical outcome. Up to the present time we have treated 13 cases of general paralysis by radiothermy.

At most we are privileged at this time to announce our plan of approach. In addition to the items mentioned in the foregoing we wish to make certain other investigations, namely, on the blood pressure, on chemical and morphological changes in the blood picture. Furthermore, we must wait until such time as we may have reports to make on the blood and spinal fluid Wassermann reactions. Still further it would add to our store of information to be able to report post-mortem findings. These last few features while highly important will not deter us, however, from the more practical issue of clinical outcome.

I feel that it is advisable at the present time to point to the fact that this particular type of work is only in its beginning and that it is entirely premature to do anything else than indicate the plan of approach. Whatever reports have been made regarding clinical outcome of patients treated at the Psychiatric Institute have not come through official channels.

Dr. Carpenter's enthusiasm may well be justified as regards the effect of heat on experimental syphilis in rabbits. He has, perhaps inadvertently, perhaps not, permitted his enthusiasm to distort the reports of careful investigators on the value of malarial therapy in human beings. I refer to the publication by Carpenter and Page, who therein surmise that "the physical methods employed (in the malarial treatment of general paralysis) are time-consuming, difficult of application, not easily controlled and, to a certain degree, dangerous". Obviously they have definitely misquoted authoritative findings, save probably in the last instance, wherein it is said that to a certain degree the method is dangerous. Its dangers, however, are far outweighed by its favorable influences.

It is, of course, too early to make any statements with respect to the efficiency of application of radiothermy to patients with a mental disorder. Perhaps radiothermy may prove to be superior to other pyrotherapeutic agents. It comprises a research problem in which we are glad to participate, and we desire at this time to express our appreciation of the cooperation of the General Electric Company in the furtherance of such difficult problems as are indicated in the present undertaking.

Dr. William Bierman (Chairman): We must congratulate Dr. Hinsie on his work. The general impression I gained from his talk is that at the present moment he does not feel like committing himself to any definite statement but that the work has been sufficiently encouraging to permit them to continue.

PHYSICAL THERAPY CLINICS

THE INTERPRETION OF ROENTGENOGRAMS OF THE MASTOIDS AND NASAL ACCESSORY SINUSES

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The following group of case reports have been selected from material in the service of the Immanuel Hospital during 1930. The clinical history, physical findings, x-ray findings and operative findings of all of these cases are available. These cases are reported to show the reliability of properly interpreted x-ray findings in mastoid disease as proven by operation.

Case No. 34301. Dr. D. R. O. Mr. N. L. Age, 37.

Diagnosis: Left acute otitis media and acute mastoiditis.

Clinical History: Severe pain in left ear for four days with inability to sleep during that time. Slight drainage for a few hours. Tender behind ear.

Physical Findings: Acute ethmoiditis and purulent secretion in both nostrils bathing the middle turbinates. Left drum membrane bulging, covered with exudate and there are several blood blisters situated on it as well as on the walls of the external auditory meatus near the drum. No apparent drainage. Very tender over extreme mastoid tip and slight swelling.

X-ray Findings, No. 3074: Left mastoid—all cells are opaque two plus. No demonstrable bone destruction. Right mastoid—normal for comparison.

Operative Findings: Pneumatic mastoid without necrosis but all cells filled with pus and granulations.

Case No. 34796. Dr. C. M. and A. R. K. D. H. Age 5.

Diagnosis: Otitis media—acute—bilateral. Mastoiditis, acute, bilateral.

Clinical History: Patient was up two days following measles when he developed a very high temperature and fever. Has no pain.

Physical Findings: Negative except for fever.

X-ray Findings, No. 3161: 3-5-30 Sinuses:

Both maxillary sinuses and all ethmoids opaque three plus. Frontals clear. Mastoids—clear.

3-19-30 Left mastoid—all cells opaque four plus. Right mastoid shows a large area of bone destruction.

3-26-30 Mastoids—right—what was reported on last examination as an area of bone destruction is an artifact. Cells are demonstrable and opaque two plus. Left mastoid cells opaque two plus.

Operative Findings: Cortex hard—no fistula—granulation tissue in all cells. Lateral sinus plate normal. Free pus in antral region.

Case No. 34574. Dr. D. R. O. Miss F. R. Age 12.

Diagnosis: Acute Mastoiditis, septicemia and meningitis.

Clinical History: Four weeks previously had scarlet fever followed by bilateral acute otitis media with high fever and development of marked jaundice, enlargement of liver and spleen. For two days has been stuporous.

Physical Findings: Both ears discharging profusely with tenderness and swelling behind the left ear.

X-ray Findings, No. 3115: Left mastoid cells opaque three plus. Large area of bone destruction. Right mastoid cells opaque two plus. No bone destruction.

Operative Findings: Left large mastoid with small cells, each one filled with pus and several large pockets of bony necrosis, filled with thick pus. The inner plate over the sinus was not involved.

Case No. 34305. Dr. D. R. O. Miss E. H. Age, 16.

Diagnosis: Acute mastoiditis with a probable phlebitis of lateral sinus.

Clinical History: Earache three weeks previous to entrance. Paracentesis performed

and the ear drained. Apparently well for ten days when patient developed high fever, without pain.

X-ray Findings, No. 3063: Right mastoid cells are all opaque four plus, and the trabeculae seem to be destroyed in the region of the knee. The lateral sinus large and high. Left mastoid normal for comparison.

Operative Findings: Lateral sinus lay immediately beneath the outer plate, with thickened walls and granulations attached in front down near the tip of the mastoid where there were a few necrotic cells filled with granulation tissue.

Case No. 34797. Dr. C. T. U. K. S. Age, 7.
Diagnosis: Acute Mastoiditis—left.

Clinical History: Discharge from left ear noted about three weeks ago. Drainage ceased and again resumed about two weeks ago,—has been continuous since then. Not much pain. Drainage profuse.

Physical Findings: Discharge from left ear.

X-ray Findings, No. 3156: Left mastoid cells of antrum and horizontal limb opaque three plus. Descending limb clear. Right mastoid normal for comparison.

Operative Findings: Mastoid cavity filled with pus and infected granulation tissue—necrosis of all cell partitions. Cells in posterior tip of zygoma filled with pus and granulations.

Case No. 35101. Dr. A. R. K. M. S. Age, 6.
Diagnosis: Acute Mastoiditis.

Clinical History: Six weeks previously right ear began to discharge—little pain. One week later ear ceased draining and had severe pain.

Physical Findings: Swollen, edematous, tender area over right mastoid.

X-ray Findings, No. 3231: Right mastoid cells opaque four plus. An area of bone destruction in descending limb. Left mastoid normal for comparison.

Operative Findings: Subperiosteal abscess—fistula over antral region. Complete destruction all cells. Lateral sinus placed forward toward posterior bony canal wall.

Case No. 35027. Dr. A. R. K. B. L. S. Age, 7.

Diagnosis: Acute Mastoiditis, suppurative—right.

Clinical History: Recurrent fever and otitis media.

X-ray Findings, No. 3215: 3/31/30 Right mastoid—cells near auditory canal and in horizontal limb opaque two plus. All other cells clear. No demonstrable bone destruction. Left mastoid normal for comparison.

No. 3259—4/19/30 Right mastoid shows all cells opaque three plus and a probable area of bone destruction in descending limb. Left mastoid normal for comparison. All accessory nasal sinuses clear.

Operative Findings: Right free pus and granulation tissue present. Unusually extensive cell development making large bone exenteration necessary. Left ear drum red and bulging. Free pus found.

Case No. 35073. Drs. C. M. and A. R. K. P. D. Age, 5.

Diagnosis: Mastoiditis, sinus thrombosis.

Clinical History: Right drum membrane opened and drained—developed measles one week after. Left drum numb—punctured.

Physical Findings: Slight nasal discharge. Right ear draining.

X-ray Findings, No. 3226: Mastoids—right shows all cells opaque four plus with a small area of bone destruction in the descending limb. Left normal for comparison.

Operative Findings: Right pus found as soon as external plate was removed. All cells necrotic and broken down and filled with pus. Epidural abscess found. Lateral sinus wall was a dull gray and partly collapsed.

Lateral Sinus—exposed and explored above and below. No free pus found—no clot found. Wound was in good condition.

Case No. 35695. Dr. A. R. K. R. A. Age, 7.

Diagnosis: Mastoiditis, acute, bilateral.

Clinical History: Three years ago ear drums were punctured and drained for three weeks. Tonsils removed three years ago. One month ago, patient felt drowsy and feverish. Two days later ear drums were found infected and later opened. Temperature septic.

X-ray Findings, No. 3376: Both mastoids show hazy cells opaque three plus. Right shows an area in descending limb which is suspicious of bone destruction.

Operative Findings: Right free pus was

found—breaking down of bony wall present—granulation tissue present.

Case No. 35527. Dr. C. M. and D. R. O. M. E. Age, 6.

Diagnosis: Mastoiditis, acute, right. Lateral sinus thrombosis.

Clinical History: Taken ill with pain in right ear, fever and diarrhea. Temperature 103° to 105.

Physical Findings: Painful right ear.

X-ray Findings, No. 3335: Mastoids: All cells of right mastoid opaque four plus. No demonstrable bone destruction. Left mastoid normal for comparison.

Operative Findings: All mastoid cells filled with pus. No bone necrosis. Anterior placed sigmoid sinus. Pus in the cells surrounding. The sinus was under pressure and welled out with pulsation. Wall of lateral sinus inflamed and much thickened but the sinus was not collapsed. Blood was aspirated from the sinus.

Right lateral and sigmoid sinuses further exposed and upper part blocked. An incision was made through the full length of the exposure and a gauze pack inserted.

Case No. 35718. Dr. C. T. U. D. B. Age, 5.

Diagnosis: Acute Mastoiditis bilateral.

Clinical History: Patient had cold, sore throat and fever. Developed otitis media and paracentesis was done. Infection extended to mastoids.

X-ray Findings, No. 3383: The cells of both mastoids opaque three plus. An area of bone destruction in descending limb of left mastoid.

Operative Findings: Cell destruction in both mastoids—more marked on right side.

Case No. 36000. Drs. R. A. S. and J. A. Y. Miss M. L. Age, 12.

Diagnosis: Acute Mastoiditis.

Clinical History: Discharge from right ear for seven days. Pain and tenderness especially over tip of mastoid. Temperature ranged from 99° to 102.

Physical Findings: Purulent discharge in right external auditory canal. Landmarks of membrana tympani obliterated. Small central perforation. No swelling over mastoid (R) but extreme tenderness over tip.

X-ray Findings, No. 3422: Right mastoid cells are all opaque four plus. On the posterior aspect of the descending limb is an area of bone destruction. Left mastoid normal for comparison.

Operative Findings: Sclerosis of bone lying posterior to posterior wall of canal and occupying almost the anterior half of mastoid. Bone over descending portion of lateral sinus necrotic and also sinus place. Tip of mastoid necrotic and filled with pus. Lateral sinus had yellowish appearance but was not opened.

Dr. John R. Caulk, St. Louis, delivered the B. A. Thomas Urological Lecture of the Philadelphia Urological Society at Philadelphia on February 23. The subject of his address was "Instrumental Treatment of Prostatism"—which refers to the so-called punch operation by electro-cautery. Dr. C. W. Collings, New York City, opened the discussion on the address and was followed by Drs. Alexander Randall, Albert Bothe and Leon Herman, of Philadelphia. The B. A. Thomas Urological Lecture was established by the late Dr. B. A. Thomas, of Philadelphia, who devised a sum of money to the Philadelphia Urological Society the income from which was to be expended in providing for an annual address on some important urological subject. In select-

ing Dr. Caulk to deliver the lecture the Philadelphia Urological Society conferred upon him the distinction of delivering the first of these lectures.

A Loss to Physical Therapy

In the death last month of Professor Holz-knecht, Physical Therapy has sustained a great loss. Holz-knecht was one of the world's authorities in radiation therapy, particularly that associated with the discipline of x-ray. His numerous researches in this field had much to do with placing it on the high scientific level that it now occupies. Probably no other man in recent times had such a large following the world over. His untimely death will be universally mourned.

CURRENT NEWS AND COMMENT

Post-Graduate Courses, Delivered in the English Language in the Leading Hospitals of Paris (France), During the Summer of 1931

The Faculty of Medicine of Paris (The Medical School of the University) announces that, during June and July, 1931, a comprehensive series of post-graduate courses will be presented. The enterprise is conducted under the auspices of the Association for the Development of Medical Relations (the "A. D. R. M.") a commission sponsored by the French Government.

The work will be presented in the English language. Clinics, lectures and demonstrations will be conducted in the great hospitals of Paris, on a wide variety of topics, by the most eminent French clinicians. A nominal fee will be charged for each course. Upon the completion of each course, the student who qualifies will receive a certificate covering the work, signed by the professor in charge.

Detailed information may be secured by addressing direct, Professeur E. Hartmann, President, "A. D. R. M.," Faculty of Medicine of Paris, 12, Rue de L'Ecole de Medicine, Paris (6e) or, in the United States, Doctor Frank Smithies, 920 North Michigan Avenue, Chicago, Illinois.

The skin of a person who gets little sunlight in winter months becomes sensitive to changes in temperature, Cornell professors have found, and this condition may make them more susceptible to colds.—*Science News Letter* (March 14), 1931.

International Hospital Congress 1931

From June 8th-14th of this year the International Hospital Congress is to be held in Vienna under the auspices of Prof. Dr. Tandler, Managing Town Councillor, and the Vienna International Fair. This will be the second meeting; the first was held in Atlantic City in June, 1929. At that time thirty-six countries were represented. The International Hospital Committee invites you to attend the

next meeting which will be formally opened June 8th in the Court Palace (Hofburg), and will have the remaining official meetings in the Fair Palace. Address all correspondence to the Secretary of the 2nd International Hospital Congress, Vienna VII, Messeplatz 1, Austria. From May 14th to June 6th the American Express Company will organize a schedule of visits for the convenience of delegates to British, Danish and German hospitals. An International Hospital Exhibition, including scientific and industrial exhibits, will be held during the Congress. All Austrian and foreign manufacturers are admitted as exhibitors of products designed for hospital use.—*Ab. Ars. Medici*, 9:138 (March) 1931.

The General Electric X-Ray Corporation has made available a new model lamp with an electric arc maintained in mercury vapor in an enclosed quartz tube, especially designed for use by the patient in the home, on a physician's prescription and under his careful supervision.

Johnson (*American Jour. of Surgery*, January, 1931), in a paper on intrinsic carcinoma of the larynx, states: "It is believed by most laryngologists that radium should be used in those cases that cannot be treated by surgery, or when, following surgery, there is a question of metastasis, for as yet surgery far surpasses any form of radium or x-ray treatment."

De Magnete

The Institution of Electrical Engineers has for disposal a few copies of the English translation of Gilbert's Treatise on the Magnet, published by the Gilbert Club in 1900.

It is a page-for-page translation of the first edition, published in 1600, and contains the numerous woodcuts, in facsimile, of the original. The size is 11¾ inches by 8 inches.

The edition, which was limited to 250 copies printed on hand-made paper, is a fine example of typography and is bound in grey-blue boards with linen-back.

The price of the work is £5 5s. (\$25.00) post-free. Remittances should be addressed to The Secretary of the Institution, Savoy Place, Victoria Embankment, London, W.C.2.

Ultra-Short Radio Waves Kill Poison of Diphtheria

Ultra-radio waves, shorter than those commonly used to send messages, are able to weaken materially the potent poison elaborated by the diphtheria bacillus, Drs. Ralph R. Mellon, Waclaw T. Szymanowski and Robert Alan Hicks of the Western Pennsylvania Hospital Institute of Pathology here have reported to *Science*.

The wave length used was 1.9 meters. The effect of temperature was carefully ruled out by using special cooling devices and by careful control tests. The strength of the poison, or toxin as it is called, was so weakened that after six hours' radiation, the amount of toxin that would kill an animal was only equal to half of one dose of the strength and amount used in skin testing for diphtheria.

This work is the modern proof of a discovery made thirty-five years ago by two French scientists, d'Arsonval and Charrin. They found that high frequency currents of 200,000 cycles per second diminished the strength of diphtheria toxin. The frequency in the modern work was 158,000,000 cycles per second. Both the Pittsburgh investigators and d'Arsonval found that the greatest action of the rays was obtained when a film of the toxin was exposed to the radiation. Possibility of using this irradiated toxin as an immunizing agent was suggested by d'Arsonval and is considered by the Pittsburgh men worth investigating further.

Survey Reveals 1930 as Country's Healthiest Year

Health workers are now wondering whether the health record for 1931 can be made to equal or better that of 1930.

In spite of business depression and unemployment, 1930 was the healthiest year this country ever enjoyed, according to statistical reports of the Metropolitan Life Insurance Co., just issued. The company's reports refer particularly to the industrial wage-earning population of the United States and Canada.

Notable reductions in the death rate for tuberculosis, typhoid fever, the principal dis-

eases of childhood, and pneumonia were found. The number of deaths from tuberculosis, diphtheria, and diseases of pregnancy and childbirth reached new low points.

Suicides increased markedly, but this death rate was lower than previous high figures recorded in the period from 1911 to 1916.

The cancer death rate increased very slightly.

Deaths from accidents were fewer during 1930 than in the previous year. This includes automobile fatalities which for the first time in 20 years showed a decline in the company's reports. However, the drop was so small as to be considered of slight significance.

The U. S. Bureau of Census has just reported an increase of 2 per cent in automobile fatalities.—*Science News Letter* (February 21), 1931.

Cambridge Will Study Magnetism in Intense Cold

A new laboratory for the study of magnetic forces at low temperatures is to be added to the University of Cambridge as the gift of the Royal Society of London.

The use of the most intense magnetic forces is planned by Dr. Peter Kapitza, of Cavendish Laboratory, who for some years has been a leader in magnetic research. Magnetic phenomena are most simple at very low temperatures when the complications due to the motion of the atoms and molecules are largely avoided.

The strongest electro-magnets in the world have already been built by Dr. Kapitza in the course of his work, by passing enormous currents through specially designed coils. Seventy thousand amperes have been used in some of his experiments for about a fiftieth of a second.

The planned laboratory will bring England back once more into the center of low temperature research, begun in 1893 by Sir James Dewar. His invention of the Dewar vacuum flask has proved of fundamental importance in the investigation of intensely cold bodies. Liquid hydrogen was first made by Dewar in 1898 in the famous Royal Institution and solid hydrogen in 1899.

Since then liquid helium has been made in Holland, Germany and Canada. Developments in this field are expected in the United States in the near future.—*Science News Letter*, (March 14) 1931.

Discovery May Bring More Knowledge of Tumors

Discovery of an inhibiting substance occurring in the tumor filtrate or extract of dry tumor material which is the causative agent of a chicken tumor has just been reported by Drs. James B. Murphy, O. M. Helmer, Albert Claude and Ernest Sturm of the Rockefeller Institute for Medical Research, New York.

The discovery was made in the course of investigations on animal tumors. Immediate application of the discovery to human tumors or cancers is not possible, but the method of investigation may point the way to valuable discoveries in the field of human tumors.

Attempting to purify the causative agent of this type of chicken tumor by adsorption with aluminum hydroxide resulted in a much less active agent in the purified substance. The fluid left after removal of the purified agent, however, proved to be far more active than the original extract. This fact, together with results of other investigations, led the scientists to conclude that both tumor-producing principle and some substance or condition inhibiting its activity existed in the fluid prior to adsorption with aluminum hydroxide. The absorption process removed far more of the inhibitor than of the principle, is the explanation of the greater activity of the supernatant fluid after removal of the purified agent.*

Germes Killed in Laboratory by High-Pitched Sound Waves

Audible sound waves, so high-pitched and so intense as to be best described as a "terrific squeak," have been used to kill bacteria by Prof. O. B. Williams of the University of Texas, bacteriologist, and Prof. Newton Gaines of Texas Christian University, physicist.

Sound waves of much higher pitch, so high as to be wholly inaudible, have in the past been used with fatal effect on living things, the pioneer experiment in this field being performed at the private laboratory of Alfred L. Loomis, banker-scientist of Tuxedo Park, N. Y. But the Texas experiments were the first in which audible sound waves were shown to be effective.

Prof. Williams and Prof. Gaines produced

their sounds by means of a nickel tube, caused to vibrate at the rate of about 8,800 oscillations per second by means of powerful electromagnetic coils wound about its lower end. The oscillating current was supplied through 250-watt radiotron tubes, such as are used in radio broadcasting stations, carrying a plate voltage of about 2,000.

The upper end of the tube was set in an inverted bottle and surrounded with water. When the current was turned on, the vibration was so intense as to cause a little mound of water to rise a couple of inches above the surface.

A flask, containing the bacteria to be "rayed," was lowered into this turbulent water mound. The sound waves passed through the glass into the fluid containing the germs, causing a disturbance similar to that which was raised in the water.

Bacterial cultures "rayed" for 10, 20, 30, 40, 50 and 60 minute periods were compared for numbers of survivors. It was found that a definite mathematical relation exists between the time of exposure and the number of survivors. At the end of one hour in the field of the waves there were less than half of the initial number of bacteria left alive in the flask.

The waves have also been tried on red blood corpuscles and have been found to be destructive to them. This is in line with similar experiments performed at Tuxedo Park, where supersonic waves of ten to a hundred times the frequency were used.*

Anti-Rachitic Vitamin to Be Baked Into Bread

A method of incorporating the anti-rachitic vitamin D in bread has been developed by the Pediatric Research Foundation of Toronto.

The method makes use of the fundamental process of incorporating vitamin D into the food in the form of irradiated ergosterol, which was developed by Dr. Harry Steenbock of the University of Wisconsin. A baking company with nation-wide distribution in the United States has been licensed under the Steenbock patents to make bread in which vitamin D is incorporated by the Toronto scientist's method. Irradiated ergosterol fat is mixed with the shortening used in the bread.*

* *Science News Letter* (March 21), 1931.

U. S. Radium May Compete With Foreign Product

It would be possible for the U. S. Bureau of Mines to manufacture one gram of radium from vanadium-uranium-radium ores in Colorado and Utah, at a cost comparable to the price for which radium can be purchased from the Belgian Congo.

Dr. G. F. Loughlin of the Geological Survey has made a survey of the mines in these states and has reported to the House Committee on Mines and Mining. This committee expects to have a hearing on a bill introduced by Representative Clyde Kelly of Pennsylvania, which directs the Bureau of Mines to produce one gram of radium from domestic sources for use in government hospitals.

Representative Kelly is in favor of increasing this to three or four grams.

In the mines in question, uranium used to be the product sought, but the ores are worked chiefly today for vanadium. Uranium and radium could be extracted from the vanadium ores as by-products, so that the chief cost of mining and exploration could be borne by the vanadium production. Dr. Loughlin suggests the addition of uranium units to existing vanadium plants or the building of new mills for the extraction of both vanadium and uranium. Of late years uranium has been mined only by gouging out small quantities to sell to manufacturers of radium belts and radio-active waters.

Although warning that his estimate is only a guess, Dr. Loughlin says he believes that radium could be extracted from these ores at a cost of \$50 a milligram.

It is expected that the House Committee will probably report favorably the Kelly bill. Representative Kelly believes that the Belgian monopoly on radium should be broken. The price of radium from the Belgian Congo is now about \$60,000 per gram.*

Fungus Causes Lung Disease Like TB

Two types of fungi were found to be the probable cause of a lung condition resembling tuberculosis in a number of miners examined for evidence of that disease or of silicosis, Drs. R. R. Sayers and F. V. Meriwether of the U. S. Bureau of Mines have just reported to the U. S. Public Health Service.

The investigation was made in a group of lead and zinc miners. The persons having

this fungus infection of the lungs did not complain of ill health and would not have seen a physician if it had not been for the routine examination made of all the employees. In the course of this examination, the condition of the lungs was found. This resembled military tuberculosis, but no tubercle bacilli could be found. Further examination revealed the fungi.*

Hot Photocells Give Largest Currents

The photoelectric cell, magic lamp that has made possible television and talking movies, yields the most electric current when it is hot—at a temperature of a little less than 1,400 degrees Fahrenheit.

To the American Physical Society in Cleveland, Dimiter Ramadanoff, instructor in electrical engineering at Cornell University, reported his researches on the effect that temperature has on the current that comes from the photocell when light shines on it. With cells using the metal barium, he found that the current increased greatly as the temperature was raised, and was at a maximum around 1,364 degrees Fahrenheit. He also found a secondary maximum for the current at 1,040 degrees, but this was only observed when the cell was illuminated with an intermittent light.*

New Vacuum Tube Detects Smallest Electric Current

The smallest electric current ever measured—about one three-hundred-quadrillionth of the current required to light an ordinary 100-watt electric bulb—can be detected with the aid of a new vacuum tube developed at the research laboratory of the General Electric Co., under the direction of Dr. A. W. Hull.

Such a current consists of a flow of only 30 electrons a second. The number of electrons flowing through the 100-watt lamp in a second can be expressed by a ten followed by 18 ciphers.

Speaking in Cleveland before the American Physical Society, Prof. L. A. DuBridge, of Washington University, told of his researches with this new tube. In the past, he said, small currents have been measured with an electrometer, which is rather a troublesome instrument with which to work. The new tube can amplify currents smaller than one ten-quadrillionth of an ampere, too minute to operate an electrometer. Dr. DuBridge also pointed out that the tube is much more convenient than the electrometer.*

* *Science News Letter* (Jan. 17), 1931.

QUESTIONS AND ANSWERS

Q. Does radiant energy as employed for therapeutic purposes cause injury of the eyes?

A. There is little or no scientific data on the subject which can be considered authentic. It has been known from clinical observation that ultraviolet rays produce a conjunctivitis on unprotected eyes. A few reports have appeared in the literature on this phase of the subject, the authors in each case designating a new term for the conjunctival inflammation produced. No one, however, has definitely shown that the conjunctivitis produced by ultraviolet is in any sense different pathologically from types of conjunctival disease due to bacterial infection. A difference may exist as indicated by the more marked severity of symptoms. The possible injuries of the eye resulting from infrared radiation has been thoroughly considered and only recently conjectured upon by Vogt who writes generally on the injuries of eyes caused by radiant energy. Vogt's article (*Schweizerische medizinische Wochenschrift*, 60:1121 (Nov. 29), 1930, was abstracted in the *J. A. M. A.* (Feb. 28), 1931, and reads as follows:

"Sunlight as well as artificial light under certain conditions may cause temporary or permanent injuries of the eyes. It has long been known that looking into the sun, which is often done during solar eclipses, is followed by temporary or permanent scotoma. The author found that this injury is mainly due to an injury of the macula lutea by burning of the pigment epithelium and the neuro-epithelium by the infrared rays. Another injury caused by sunlight is the snow blindness developing in the high mountains. This is caused by ultraviolet radiation, which injures especially the cornea and the conjunctiva. Glass blowers' cataract, the pathogenesis of which was not entirely clear until recently, is caused by infrared radiation. In regard to roentgen injuries of the eye it is stated that they become noticeable either shortly after the irradiation or after a longer interval. The author advises against the treatment of blepharitis with small doses of roentgen rays, be-

cause this disturbance usually yields to medicinal therapy, and although roentgenologists assert that small doses of roentgen rays are not injurious to the eye, the late effects on the lens cannot be definitely denied. Injury of the eye may also be caused by radium rays. It is similar to that caused by roentgen rays."

Q. What special advantages do high frequency currents possess in the treatment of chronic endocervicitis?

A. Surgical diathermy in its several forms have been described as being advantageously employed in cervical inflammations. Numerous methods have been suggested and special electrodes are now available for purposes of eradicating and destroying the diseased endocervical mucous membrane with its glandular structure. Hyams (*Arch. Physical Therapy, X-Ray, Radium*, Vol. XI, No. 4 (April) 1930, enumerates the advantages of conization, a special procedure for treating chronic endocervicitis by his technic:

"The method is used for the treatment of ambulatory patients.

"The patient suffers no pain or discomfort.

"The symptoms are relieved because the mucous membrane with its contained glands is removed, thus aiding nature in repair and at the same time expediting the healing process.

"The danger of subsequent bleeding is practically nil.

"No muscular tissue is removed, the cervix remaining functionally normal, and future parturition is not interfered with mechanically.

"The cervix need not be drawn down to the vaginal introitus, thus avoiding the possibility of subsequent retrodisplacement of the uterus.

"The cutting proceeds smoothly, the generated heat assuring asepsis.

"Tissue can be removed to any desired depth.

"Conization can be used for removing tissue for microscopic examination particularly

in cases where dilatation and trauma are inadvisable.

"The procedure may be repeated as often as is deemed advisable to accomplish its object.

"Removal of the diseased tissue promotes and facilitates lymphatic drainage.

"Conization results in a minimum of scar tissue because the division of the tissue is accomplished far more accurately than with the finest knife."

Q. What influence on arterial hypertension is produced by physical therapy?

A. The articles dealing with this question which have appeared in the recent literature can be said to be overenthusiastic and conservative. There is no doubt that diathermy as autocondensation therapy has an influence on arterial blood pressure. Whether the effect is permanent is problematic. Physical measures alone should not be depended upon for curative results. The underlying cause should be sought and removed. When this is not possible symptomatic treatment may be employed to advantage. An interesting treatise on the subject, by Jacob Gutman, appeared in the *Arch. Physical Therapy, X-Ray, Radium* (Vol. X, No. 6, June 1929). The conclusions follow:

"1. We must treat our hypertension cases individually, and meet the conditions presented in each case.

"2. Every form of therapy should be used which experience teaches is beneficial; no one system is applicable to all.

"3. Accompanying complications must be attended in a manner best known for these diseases.

"4. Toxic, endocrine, constitutional disturbances, wherever possible, must be removed, or at least attenuated.

"5. Suppurative foci must be eradicated.

"6. Colonic irrigations are to be administered in normal colons at least once or twice a week, and in the abnormal perhaps more frequently. Large quantities of alkalines and salines, followed by mild antiseptics or implantation of acidophilus bacilli must be instituted.

"7. All colon abnormalities leading to intestinal stasis, bacterial activity and production of toxins, must receive appropriate treatment as indicated in each case.

"8. Electric cabinet baths for the elimination of uric acid and other poisonous substances; massage and Bergonie treatment to improve the circulation and reduce excessive weight; special dietary measures must be observed:—restricting quantity in obesity, carbohydrates in diabetics, salts and purine rich foods in nephritics. Rest, personal hygiene, restriction of physical and mental strain should be prescribed in all cases as part of the general treatment."

Q. What changes occur in the uterus as a result of irradiation of uterine tumors?

A. A pertinent article dealing with this question appeared in the *Folia Gynaecologica* (27:325, 1930). The author, O. Macchiarulo, writes:

"Irradiation in ordinary therapeutic doses affects the uterine mucosa, producing various degenerations of the cellular elements; pyknosis, karyorrhexis, vacuolation and changes in the aspect of the glands. Not even the muscular tunic of the uterus is immune to the action of the rays—atrophy, necrosis and fibrosis. The cell resistance of the uterine vessels is suppressed and these show various changes in the vascular tunics. From the researches of the author, there develops evidently an angioplasia in the irradiated tumors. The histochemical changes that are observed in fibromyomas extend to all neoplastic elements: muscular fibrocells, connective tissue fibers, vessels. The author ascribes the changes to factors of a chemical, physical and colloidal nature called into action by the irradiation. The author agrees with previous investigators in attributing to a reaction of the mesenchyma the leukocytic, lymphocytic, plasmacellular and histocytic infiltration observed in irradiated tumors. The loss of the cilia, the rupture of the cell nucleus and vacuolation of the elements of the tube are phenomena specifically assignable to the modifying action of the intra-uterine radiant energy: Emanations of radium coming from the uterine cavity produce atresia of the follicles in advanced maturation in the prolapsed ovaries and in a state subject to the influence of irradiation. It is possible, however, that the follicles, after a period of latency, reacquire their normal function."—(Ab. J. A. M. A., Feb. 14, 1931.)

THE STUDENT'S LIBRARY

BOOK REVIEWS

PRACTICAL MASSAGE AND CORRECTIVE EXERCISE WITH APPLIED ANATOMY. By *Hartvig Nissen*, Late President of Posse Normal School of Gymnastics; for twenty-four years Lecturer and Instructor of Massage and Swedish Gymnastics at Harvard University Summer School; Former Instructor of Physical Training at Johns Hopkins University and Wellesley College, etc. Fifth Edition, revised and enlarged by *Harry Nissen*, President, Posse-Nissen School of Physical Education, Boston, Mass. Cloth. Pp. 271, with 72 illustrations and line engravings. Price, \$2.50 net. Philadelphia: F. A. Davis Company. 1929.

The present volume is the fifth revised edition of a work that was first published in America by one of the early pioneers in Massage and Corrective Exercises. The present editor, a son who has followed in the footsteps of the father, calls attention that many of the so-called new additions to corrective exercise are not new and were taught by Ling of Sweden in the early nineteenth century and introduced in America by his father as far back as 1883.

The book is divided into three parts. The first deals with, "Manipulations and Their Effects"; the second with, "Applied Anatomy and Corrective Exercise"; the third with "Treatment of Injuries and Diseases." The volume is, therefore, a well-rounded concept of the art of manual manipulation, the anatomy involved and the use of certain corrective exercises necessary in the treatment of various diseases and injuries, including a discussion of flat feet.

There is unity and orderly arrangement of the subject matter under discussion. For example, the first chapter deals with the definition, history and effects of massage; chapter two discusses the classification of movements—their execution and effects, and the following six chapters attempt to explain the application of massage to various parts of the body. Altogether, the first section of the book is an intelligent exposition of the outstanding principles of what is at present generally accepted as worthwhile in manipulation.

Not so much can be said for the last part—that dealing with the clinical phase of this book. As one reads deeper in its pages one obtains the unpleasant impression that its exposition contains an aggressive quality foreign to scientific publications. One closes the book with a rather keen impression of the absence of medical orientation. There is too much of the "lingo" of the massage parlor and the colloquialism of the "rubber" to carry conviction to the medical reader in search for special information. The description of the author's many experiences has a quality of robust muscle health, if one may use that term, that is not altogether pleasant to peruse. His statements carry a quality of positive aggressiveness that would require equal force to resist. The author at times shows an uncanny tal-

ent for prognostication, as in the case of the patient who suffered for seven weeks with neuritis of the arm that could not be relieved "with all sorts of remedies, among them electricity and vibrator machine," but who became promptly well in exactly five treatments as was promised him.

The reviewer feels convinced — indeed, he is "sold" — on the fact that the author is probably the best masseur of his kind; but he openly doubts the ability of the writer to pass judgment on many of these cases without the aid of a physician. It is, however, unfortunate that much of the virtues of massage are unknown to the average medical practitioner.

THE WORLD ABOUT US. A General Science. By *William Dean Pulvermacher*, M.A., LL.B. Chairman, General Science Department and *Charles H. Vosburgh*, M.A. Principal, Jamaica High School, New York City. Cloth. Price, \$1.60. 328 Pp., with many illustrations. Boston, Mass. D. C. Heath & Company. 1930.

Physicians interested in radiation therapy have long felt the need of information on the physical background of the subject. This volume tells the story of "The World About Us" in an organized and interesting fashion. Cardinal facts and applications of chemistry, physics, meteorology, astronomy, mechanics, light, and electricity are presented in a manner that fixes the data in one's mind by arousing the interest of the reader in the subject under discussion. The laboratory method is used and yet, there is little of advanced mathematics utilized in the many experiments found throughout the various chapters. Although the text has been organized on the science of life, physicians who have been long removed from scholastic environment will find the material of this book a splendid review of the basic facts of the subject so intimately related with this therapy. Physical Therapy has been in need of a lesson text that permits the physician to see in perspective the fundamental sciences and their relation to life.

The latter half of the book takes up the study of living things, beginning with a particularly clear and well illustrated chapter on Plants and Their Functions. The last two fields explored are physiology and bacteriology. The use of food-fuel by the human body, food values, human requirements in calories, food preparation and digestion are developed in considerable detail. The study of micro-organisms gives a brief review of the wonderful story of discovery and research in this field and the wars against our disease-bearing enemies in the micro-organic and the insect worlds. Each chapter is summarized in a few short sentences, covering the important points with unusual brevity and conciseness.

At the end of the book the reader will have an organized knowledge of general science; an appreciation of what science has accomplished in the world; he will come away with an open mind, de-

siring to learn more, and with a realization of the incompleteness of science, i. e., the fields still waiting for the pioneer and inventor; and above all, with a working knowledge of that most intricate machine in the world, his own body.

THE PATHOLOGY OF THE EYE. By *Jonas S. Friedenwald*, A.M., M.D., F.A.C.S. Associate in pathological ophthalmology at the Johns Hopkins University, Pathologist of the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital. The Macmillan Company, 1929.

This well written book on pathology of the eye will be a source of great pleasure to students. It is informative and authoritative and written with a clarity and style which other medical writers well emulate. The easy manner in which the author discloses his pathological pictures against the background of etiological and clinical considerations is an inspiration to those who interest themselves in effective medical pedagogy. The ophthalmologist and pathologist, undergraduate and practitioner, will thoroughly appreciate the erudition and simplicity of the presentation of the effects of systemic disease in the production of ocular pathology; of the correlation of the newer chemistry; of the manifestations of allergic phenomena. The 253 illustrations which are mainly microphotographs from the pathological collections of the Wilmer Ophthalmological Institute and the Army Medical Museum, are worthy of being included in the text. They help in a noteworthy measure to make this volume one of the most welcome works in the medical library.

THE TREATMENT OF ASTHMA. By *A. H. Douthwaite*, M.D., F.R.C.P. (Lond.). Assistant Physician, Guy's Hospital; Physician in Charge of Massage Department, Guy's Hospital; Hon. Physician, All Saint's Hospital. Pp. 164. London. H. K. Lewis & Co., Ltd. 1930.

Twelve chapters comprise this book of 164 pages devoted to the various aspects of asthma. The author has endeavored to present in "an assimilable form all facts and theories of practical importance which are relevant to the subject, in order that those who lend their aid to the campaign against asthma shall be enabled to bring their knowledge up-to-date without the necessity of a laborious search through the vast literature which now exists."

A striking statement is the admission that only a minority of asthmatics can be cured. This is in contradistinction to more encouraging prognosis on the part of others who have written on the subject. Little or no criticism can be made of those chapters which deal with the fundamentals, the etiology, diagnosis, and the metabolic and bacteriologic phases of the affection. In fact, there is little to criticize on the author's consideration of the treatment. While any number of therapeutic suggestions have been offered during the past three decades, only an extended experience on the part of any clinician can rationally segregate those which should be included in a clean-cut discussion of this very important medical problem.

Physical therapy is emphasized as an aid to other

treatment methods. According to the author, treatment by diathermy alone never results in cure of asthma, but it is a very useful adjunct to other therapeutic measures in those patients whose attacks originated from a respiratory infection. Like diathermy, x-ray treatment should only be used when more rational lines of treatment fail.

A notable statement, and one which has been experienced by workers in this country as well, is the fact that whatever benefit ultraviolet radiation confers will be seen at its best in young patients and not in the confirmed asthmatic.

The conservatism throughout this little volume merits special mention. Asthma has been handled in none too scrupulous a fashion. Every type of remedy has been heralded as a panacea. It is refreshing, therefore, to read a clean and wholesome review and a truthful appraisal of present methods of therapy.

A TEXTBOOK OF MASSAGE. By *Maude Rawlins*. Instructor of Massage to Nurses at St. John's Hospital, Brooklyn, and Long Island Hospital, Brooklyn, etc. 140 pp. with 18 illustrations. Price, \$2.00. St. Louis, The C. V. Mosby Company, 1930.

The author who has had thirty years of work in this field of therapy and in teaching the methods to nurses presents this useful little book not "as a scientific treatise on massotherapy," but "what and how I have given the instruction to my students." Inasmuch as the New York State Nursing Department requires sixteen hours of training in massage, only a superficial outline is attempted in this brief volume.

The author divides the work into twenty-four chapters as follows: Public Opinion, History, Science of Massage, Theory of Massage, Terms, Effleurage, Stroking, Pétrissage, Kneading, Rolling-Kneading, Friction, Fulling, Wringing, Tapotement or Percussion, Vibration, General Massage, Convalescence, Headaches, Chronic Constipation, Breasts, Orthopedics, Babies and Children, Rheumatism, and Emergencies.

The author has caught the spirit of the training needed for a successful massage by emphasizing the value of gentleness in all phases of the practice of massage. In the Theory of Massage, the student is instructed to "gently stroke up, and gently and slightly increase the pressure, and gently cling to or hug the muscles." They are further told that "the old idea of an hour's steady work has been proved bad in most conditions for a little gentle stimulation acts as a tonic while a long treatment may be exhausting." The author believes that "no machine has been invented to equal the trained human hand."

In perusing this book, the reviewer questions the value of having so many chapters only two and three paragraphs in length. For instance, each move is given over to one chapter. Then, Chapter XVI treats of all the movements, by describing a general body massage. The chapter on Orthopedics is merely touched upon as the author believes the present volume inadequate to treat of this subject. Lengthy chapters discuss massage of the breasts, and massage in constipation. It is believed that these two phases are beyond the field of the nurse.

The average nurse's training includes very little or no opportunity to become experienced in the rhythmically controlled movement so desirable for the proper results to be attained. It is unwise to permit the nurse to feel qualified to massage these sensitive parts of the body. This book is somewhat too superficial to be placed in the hands of individuals without a strong background in the subject.

The mechanical makeup of the book is commendable. The drawings lend vividly to the usefulness of the book. The subject of massage as a therapeutic aid is now being forcibly brought to the attention of the profession. A little volume such as this is, therefore, useful to those who desire a simple review of massotherapy.

PRACTICAL TREATISE ON DISEASES OF THE DIGESTIVE SYSTEM. By *L. Winfield Kohn, M.D., F.C.A.P.*; Chief of the Gastro-intestinal Department, Temple University, Philadelphia; Present Chief of the Gastro-intestinal Clinic, Leimanon Hospital, New York City; Chief of the Clinic of the Gastro-enterology, Medical Chirurgical College, Philadelphia, etc. Cloth, Pp. 1125, illustrated with 542 engravings, including 7 full-page colored plates. Two volumes. Philadelphia: F. A. Davis Company, 1930.

The foregoing treatise represents a tremendous labor well organized and efficiently expended. It is incorporated in two compact and surprisingly handy volumes in spite of the 1125 pages in which it is embodied. The publishers are to be highly commended for the fine mechanical and attractive makeup of these two volumes.

In these days of high speed, rapid living, and the expansion of maximum nervous energy in order to survive the killing pace of modern civilization and competition the modern human is more often subjected to gastro-intestinal upsets than ever before. Indeed, Gastro-enterology is today a very flourishing speciality, and the general practitioner meets with a greater number of patients suffering from perversions of the gastro-intestinal mechanism than in previous years. And by the same token, the literature on this phase of medicine has grown apace and become top-heavy.

There has long been a need for a treatise that would present the facts of the subject in detail and remove some of the redundant ideas that have begun to clutter its literature. The author has accomplished this labor with success. It is surprising that in spite of succinct presentation of the subject that the treatise has assumed encyclopedic proportions. There are twenty-two chapters altogether; but some of them are veritable monographs in length and authority. The first ten chapters might well be considered the theoretical introduction to the clinical exposition which follows. The reviewer considers this part of the treatise invaluable to any student, general practitioner or any specialist interested in gastro-enterology. The subject matter is concisely presented and includes the following subjects in its discussion: (1) Anatomy and Histology; (2) Physiology; (3) History Taking; (4) General Observations and Objective Findings; (5) Mechanical, Chemical, and Cytologic Methods of Examination; (6 and 7) Clinical Significance of

Secretory and Excretory Findings; (8) Fluoroscopy and X-Ray; (9) Neurological Considerations; (10) Clinico-Physiological Considerations.

It is but natural that where the material and the sub-headings are so voluminous that difference of opinion may well arise in regard to whether certain portions of the subject were exhaustively evaluated or cursorily dismissed. Much of this suggests itself throughout the book; but it would be attempting to split hairs to do so, and an injustice to the scholarly and tremendous labor of the author. That the treatise is a well rounded effort is demonstrated by such chapters as "Dietary Considerations," which discusses the nutritional problems associated with the many symptom-complexes encountered in this speciality; or the one on "Therapeutic Considerations," which intelligently reviews the values of various forms of intubations, irrigation of the colon, hydrotherapy, gymnastics, massage, electrotherapy, orthopedic measures, psychotherapy, diathermy, ultraviolet radiation, Grenz Rays, X-Rays, etc.

This work represents the modern viewpoint of gastro-enterology and includes an exhaustive and concise presentation of the modern concepts in management. Since the subject presents such broad interest in modern medicine these two volumes are of practical interest to all active members of the profession and are highly recommended.

CLINICAL OBSTETRICS. By *Paul T. Harper, Ph.B., M.D., Sc.D., F.A.C.S.*, Fellow of the American Association of Obstetricians, Gynecologists, and Abdominal Surgeons, and of the New York Medical Society; Clinical Professor of Obstetrics, Albany Medical College, etc. Cloth, Pp. 614, with 250 figures, and 84 plates of engraving with legends and charts. Price \$8.00. Philadelphia: F. A. Davis Company, 1930.

This book, designed for use by post graduate students interested in obstetrical problems has presumed that its reader has acquired a foundation of fundamentals from standard text-books and is acquainted with the current literature. The author makes use of many sketches and tables to explain complicated matters or to condense and summarize certain obstetrical procedures. By means of serial diagrammatic sketches the normal and abnormal mechanisms of labor are easily reviewed. In the same manner, together with the descriptive text, the chapters dealing with forceps and versions are most excellent. All of the important forceps operations are thus described. However, in certain parts of the book the author's style becomes difficult to follow and some of his tables are hard to interpret.

For eclampsia, all of the known therapeutic procedures are described, but one does not easily determine the author's personal attitude and just what measures he favors. For a book dealing with clinical obstetrics, it might perhaps be improved by including some illustrative case histories and more detail on the types of caesarian section. Nevertheless, the context is entirely original and unique in the plan of presentation in conjunction with numerous descriptive sketches.

INTERNATIONAL ABSTRACTS

Effect of Radiant Heat on Production of Actinic Erythema. F. M. Shattock and M. D. Waller.

Lancet 2:917 (Nov. 2), 1929.

Experiments were made by Shattock and Waller to ascertain whether the addition of "radiant heat" rays had any appreciable effect, either synergic or antagonistic, on the production of actinic erythema, and whether, if any such effect is noted, it can be attributed to some "physiologic" action or "physical" cause. They found that heating tissues by radiation or by conduction (radiator, hot water in vessel) after exposure to ultraviolet radiation diminishes—or suppresses—the actinic erythema and delays its appearance. Heating of tissues by radiation or conduction before exposure to ultraviolet radiation increases the actinic erythema. The time of appearance of the actinic erythema is not appreciably influenced. Heat (radiant heat or hot air draft) applied simultaneously with ultraviolet irradiation diminishes—or suppresses—the actinic erythema and delays its appearance. Differences in color as well as differences in depth of reaction are noticeable. The actinic erythema of the heated skin is more scarlet or vermilion (similar in color to the primary erythema), as compared with the actinic erythema produced by the mercury vapor or water filtered carbon arc light, which is more crimson or carmine. Differences of from 20 to 30 per cent of exposure to ultraviolet rays are necessary to produce visual differences in the erythema. Smaller percentage differences of exposure to a given source of radiation will give appreciable differences in the latent period—i. e., the time elapsing before the appearance of erythema. The diminution of actinic erythema by heating the tissues, either with radiant heat or by conduction, during ultraviolet irradiation, suggests a "physiologic" rather than a "physical" cause for the diminution observed. The fact that at least equally satisfactory diminution of erythema can be obtained by heating after irradiation with ultraviolet rays cannot be explained on the basis of physical interference or antagonism of the rays. The observed action of ultraviolet rays on the sensitiveness of the skin to thermal stimulation appears to be immediate. It is suggested tentatively that this action may be a factor in determining the degree of actinic erythema in cases in which heat is applied simultaneously or after ultraviolet irradiations.—*Ab. Arch. Derm. and Syph.* 23:470 (March) 1930.

Chilblains Treated by Melted Paraffin Wax Bath and Ultraviolet Rays. F. H. Humphris.

Practitioner, London 125:449 (Oct.) 1930.

The melted paraffin wax bath was introduced by the late Colonel Littlewood during the latter part of the war. Results of observations and tests have proved that this bath is of considerable therapeutic value in itself and also as a preliminary for massage and other treatment, and its properties make

it an important factor in the armamentarium of modern physical therapeutics. The bath used by Humphris is made of fire-clay 3 inches thick (this is necessary to prevent radiation of the heat); it is 6 feet long, with parallel sides, white glazed inside and over all; it is supported by four white glazed fire-clay pedestals, and has a stoneware draw-off tap, and is fitted up with a self-contained electrical heating apparatus and heat-regulating switch; this is fixed at the tap end of the bath and keeps the molten wax in circulation. The whole heating apparatus is enclosed in white enamel ironwork. Another bath of similar construction, but built vertically, is also used, and smaller baths for the limbs have also been constructed, but in these it is difficult to regulate the heat satisfactorily on account of their smaller capacity. Paraffin wax with a melting point of 120 F. is placed in the bath in large cakes and heated by two temporary coils of wire; when the wax is sufficiently heated, these may be removed and the bath heated at will by the permanent heaters. The patient remains with his hands or feet in the bath for about twenty minutes, at a temperature of about 120 to 130 F. At the end of this time the part under treatment is removed from the bath and allowed to cool. After two or three minutes the wax can easily be peeled off the limb. Other conditions besides chilblains which Humphris has found to respond to this treatment include neuritis, rheumatic and gouty joints, fibrositis, especially in and around small joints, scleroderma following old lymphangitis, cramp in the calf of the leg, intermittent claudication, eczema vesiculosum, phlebitis and Raynaud's disease. Slight mechanical irritants produce bullous elevations of the epidermis over the nodules, or doughy swellings, and those blister-like formations, filled with blood-stained serous fluid, are apt to break down and form atonic ulcers which heal with difficulty and present the commonly called broken chilblain. Here the ultraviolet rays are most useful, and with their use the abraded surface readily heals. The daily application of a mild dose of the rays soon stimulates the sluggish ulcer and promotes healing, and then the cure proceeds as in the unbroken variety.—*Ab. Jour. A. M. A.* 95:1623 (Nov. 22), 1930.

Ultraviolet-Conjunctivitis — Calcium. Prof. R. Bährny, Upsala.

(*Schweizer medizinische Wochenschrift*, No. 39, 1930.)

The author has tested on himself the effectiveness of lime therapy in a severe irritation conjunctivitis following ultraviolet irradiation without eye protection. Half hour after the taking of nine Kalzan tablets all symptoms (pain, burning, copious flow of tears, swelling, etc.) had disappeared and, when six hours later they reappeared, the taking of 12 more tablets eliminated them permanently.—*Ab. Ars Medici*, 9:131 (March) 1931.

The Use of Surgical Diathermy About the Mouth of the Eustachian Tube for Infection and Catarrh of the Middle Ear. Lee M. Hurd, M.D. *Annals Otol., Rhinol., and Laryngol.* Vol. XL, No. 1, March, 1931.

Hurd presents a method for obliterating the lymphoid tissue in the pharyngeal recess and destroying the infected lymph follicles. The procedure is that of electrocoagulation, employing variously shaped, insulated active electrodes, with pointed or dull tips, through a Yankauer nasopharyngoscope.

The author insists that the technic of using high frequency coagulating currents is hard to explain in definite terms. Fairly slow coagulation about the needle is desirable.

The procedure is carried out to all lymph follicles, if they are isolated as they are on the tubal cushion. The needle is plunged into the center of the follicle and the current turned on until the follicle turns white. In the pharyngeal recess the first difficulty is that unless the nasopharyngoscope is passed very gently the adhesions will be torn and blood will interfere with vision as well as with coagulation. The adhesions should be destroyed before they are torn apart by the nasopharyngoscope. All lymphoid tissue in the pharyngeal recess should then be destroyed.

Coagulation of the lymphoid tissue below the tube must be done especially carefully or the result may be a paralysis of the levator veli palatine muscle. If the lateral pharyngeal fold contains much hypertrophied lymphoid tissue this should also be coagulated.

It takes from ten to fourteen days for the slough to disappear and about four weeks before complete healing is effected. Considerable practice is required to gain a knowledge of how deep to insert the needle and what amount of coagulation should be done.

Surgical Diathermy in Diseases of Nose and Throat, Especially in Malign Tumors of those Regions. Walter Hesse.

Deutsche med. Wochenschr. 56:1479 (August) 1930.

The author found surgical diathermy very useful in cases of lupus of the nose, tuberculosis of the larynx and as a means to separate adhesions. Good results followed in small malignant tumors of the larynx, where he combined this method with surgery. Tumors of the nasal sinuses were found to be an inoperable procedure with surgical diathermy. On the contrary, favorable results were obtained in tumors of the maxillary sinus that did not expand or encroach upon the dura mater.

In cases of papilloma of the larynx the author could not observe any unusual results due to surgical diathermy. The author favors the combining effect of surgical excision and the diathermization of the base of the wound. He attributes his good results to the combination of both procedures.

The value of surgical diathermy is due to the fact that it immediately helps to seal off the blood and lymph vessels by coagulation. This should be extended some distance into the healthy tissue in order to avoid metastasis of tumor cells.

Neue Erfahrungen Auf Dem Gebiete Der Häutuberkulose Mit Besonderer Beruecksichtigung Der Gersondiaet. (Recent experiences in the field of cutaneous tuberculosis with special reference to Gerson's Dietary). Sigwald Bommer. *Strahlenther.* 35:139 (Jan.) 1930.

In the field of lupus treatment a reversal of opinion, dating nearly 14 years, has taken place and it is now thought that the local treatment of the active foci is of less importance than general body treatment. At best, the local treatment is considered merely as a compliment. In systemic treatment generalized sun baths play a great part; generalized irradiation with the mercury vapor lamp is administered in the cold season, as a matter of substitution. In addition to this the diet advocated by Gerson has been found of value in lupus as also in other forms of surgical tuberculosis. This diet is practically salt free, rich in fats and vitamins and poor in carbohydrates. Besides this diet, a mixture of salts, called mineralogen is given after meals as well as one spoon and a half each of phosphorated cod liver oil twice daily. Lupus foci apparently heal under the action of this diet. The healing time varies with the individual (taking from 6 months to one year and a half as the average). Recurrences have not as yet been observed and judgment must be withheld as to the permanence of cure until a greater time has elapsed. While treating with Gerson's diet, the author has given up every other diet. During the whole summer of the year 1929, almost 50 percent of the lupus patients of the author received, of course, no other treatment, even excluding the sun baths. In regard to the other patients the following observations could be made: generalized sun baths exert a favorable influence when the diseased foci themselves are protected from light by bandages. It is wise to keep off any irritant, also light stimulations, from the diseased focus, for otherwise the healing process inaugurated by the diet would be delayed. Local interventions are to be abstained from. Local irradiation impedes progress. X-ray irradiations of the lupus foci are most suitable. These are facts that cannot be urged too strongly.

Die Operation Mit Schneidener Elektrizitaet. (Operation by cutting electricity). Rudolf Dyriff.

Munch. Med. Woch. 76:1885 (Nov.) 1929.

Dissection of the tissues can be obtained by a diathermic current but the zone of incision is surrounded by too heavy an area of coagulation to heal up by first intention. This fact was due to the length of sparks in the diathermy apparatus hitherto in use. By increasing the train of sparks at the spark gap, a cutting efficiency was attained which produced maximum cutting and minimum coagulation. This was accomplished by raising the spark gap discharge from 8,000 to 50,000 per second.

The author uses the Kaustik Thermoflux K of the Siemens-Reiniger-Verfa Works in Berlin for operations to be done by cutting electricity. This arrangement permits of incisions associated with such a minimal amount of coagulation that the wound can be sutured like a scalp incision which

heals up by first intention. For the purpose of surgical gynecology convenient operative electrodes have been devised.

Tissue dissection by means of cutting electricity affords in certain cases particular advantages as compared with division by knife, because the electric cutting sterilizes the cut surface simultaneously. The advantages characteristic of this procedure is in operations associated with infectious or cancerous areas. Beside the sterilization of the cut surface it particularly insures against the dissemination of the disease through open lymph and blood channels in operation, which is of outstanding importance. To this may also be added the saving of unnecessary loss of blood because of its ability to seal the capillary vessels at the same time. This procedure is preferable in enucleation of vulvar caruncles, abscesses of Bartholin's glands, ablation of necrosed myomas and polypi born into the vagina, excision of chronic lacerated and distended ulcers of the vaginal wall and portio, in enucleation of chronic abscesses of the breast and fistulae consecutive to abscesses and in laparotomies in the area of inflammation. Of especial importance and benefit, however, is the substitution of scalpel operation by electric cutting in all surgical interferences for carcinoma and sarcoma.

Influence of Diathermy on Activity of Stomach. L. Klyachkin and E. Mogilevskiy.

Kazansky Meditsinskiy Jurnal, Kazan, 26:963.

The observations of Klyachkin and Mogilevskiy were made on forty-two patients with various dyspeptic disturbances. A combined chromoscopic and fractional method was used for exploration of the gastric secretion. The gastric contents were removed while the person was fasting, and immediately afterward 2 cc. of a 1 per cent aqueous solution of neutral red was injected intramuscularly. Evacuation of the stomach was repeated with the person fasting, twice at a ten minute interval, and the gastric juice secreted within thirty minutes was examined. Then a caffeine test meal (Ratsch and Kalk) was introduced with a catheter, and the gastric contents were withdrawn every fifteen minutes for about two and a half hours. For determination of the gastric motility, phenolphthalein was added to the test meal. The same procedure of exploration was repeated after the diathermy treatment. One electrode, of from 100 to 150 sq. cm., was applied to the gastric region, and another electrode, of from 150 to 200 sq. cm., was parallelly applied to the back. A current of from 1 to 1.5 amperes was used; the duration of each sitting was half an hour. Repeated examinations after the treatment were made on twenty-five patients. There were no changes of gastric secretion in three of six patients with hyperacidity. In one the gastric juice secreted during fasting was reduced by 40 cc. In two, the decrease of the gastric juice was by 82 cc.; besides, elimination of the neutral red appeared prolonged by three minutes (from nine to twelve minutes) after fifteen sittings of diathermy. In five of seven patients with a normal gastric acidity, the diathermy treatment proved to be without action on the gastric secretion and motility. In one instance the secre-

tion of the gastric juice increased by 64 cc.; elimination of the neutral red occurred in twelve instead of eighteen minutes. In another patient the gastric acidity was notably decreased. In two of three patients with hypo-acidity the gastric juice remained unchanged; in the third there was an increase of the gastric acidity and of the gastric secretion (by 54 cc.) and an accelerated elimination of the neutral red. In nine patients free hydrochloric acid was absent and the gastric secretion was notably reduced; in five of them elimination of the neutral red did not occur. In only two cases in which elimination of the neutral red was not entirely abolished did the diathermy treatment result in the appearance of free hydrochloric acid and in an increase of the gastric secretion. In the remainder, no changes were observed after fifteen sittings. These cases of achylia presented a group of "complete and true anacidity" in which the lesions of the gastric parenchyma were severe. The authors conclude that, in cases of gastric hyperacidity, diathermy treatment is followed by an improvement of the subjective as well as the objective signs. In cases of organic achylia, the treatment had no influence on the gastric secretion; but it induced improvement of the general condition and caused the disappearance of subjective signs which had previously resisted various remedies and diets. Therefore diathermy is recommended for patients with dyspeptic manifestations, regardless of the condition of the gastric acidity.—*Abs. J. A. M. A., Vol. 96:990, (March 21,) 1931.*

Die Schlammbehandlung Von Maennern Per Rectum. (Rectal mud treatment of males). Barschansky.

Ztschr. f. Urol., 24:184 (March) 1930.

The author feels that rectal mud treatment is indicated not only in chronic and subacute cases, but also in acute ones, except for those running a particularly violent course (hematuria, urine retention, formation of abscess). In acute processes, in which the subjective, unpleasant sensations of the patient are strong, the very first introductions of mud are immediately followed by a decrease of the painful sensations and dysuric manifestations. Rectal mud therapy is also the only therapy applicable to diseases of the gonads in cases with decompensation of the heart, where even another mud application constitutes a load surpassing the power of the diseased heart. The improvement of defecation observed by the patients themselves is to be emphasized as a pleasant by-effect of this procedure. Contraindications are all inflammatory, ulcerous and new growth processes in the rectum, also abscesses, hypertrophy and neoplasms of the gonads, and tuberculous affections of the urogenital organs. The mud is applied by means of a particular syringe devised by the author; the introduction of mud is carried out on alternate days; the course averaged from 15 to 20 introductions. The treatment was well tolerated; the patients experienced no difficulties in lying for from 20 to 40 minutes with the mud heated up to from 45 to 55 degrees C.; indeed, it was observed that they could even retain the mud for 1 or 2 hours.

Die Wirkung Der Glaubersalzquellen Im Licht Moderner Forschung. (The effect of sodium sulphate springs in the light of modern investigations). Walter Arnoldi.

Ztschr. f. wissenschaftl. Bäderkde., 4:750 (May) 1930.

Under the influence of sodium sulphate waters the secretion of bile and also of bilirubine is materially stimulated to flow in larger quantities into the intestines. Consequently the following takes place: better utilization and absorption of the food stuffs—particularly fat, stimulation of the motor function of the intestines, increased elimination of bile constituents by the tissues, and modification of the secretion of gastric juice. This stimulation of the activity of the liver doubtless refers not only to the bilirubin metabolism, but also to other functions of the liver, especially in reference to the carbohydrate metabolism. The action of sodium sulphate influences the elimination of ketone bodies. Under the influence of these waters one sees first an increased elimination of ketone bodies, especially in cases of mild diabetes. Along with the improvement of the carbohydrate metabolism acetonuria then slowly decreases. Increased formation of ketones, in addition to diabetes, is met with in gastro-intestinal affections, diseases of the liver, bronchial asthma, alcoholism, infectious diseases and after copious intake of meat. Increased acetonuria is above all suggestive of a trouble in the carbohydrate and fat metabolism. Through action of sodium sulphate springs on acetonuria, from other observations made in diabetes mellitus, there is found an increase in the sugar tolerance, diminution of glycosuria, fall in the increased blood sugar level in mild and likewise occasionally in moderately severe cases, but not in severe diabetes. In conclusion the author points out that the acid-base equilibrium of the body is influenced by a drinking cure as performed by the Mühlbrunn of Karlsbad, an increase of the alkali reserve, i. e., of the bicarbonate content of the plasma which becomes ascertainable. Thus the margin of the metabolic function is enlarged, inasmuch as the capacity for neutralizing acid valences proceeding from the metabolism to a larger extent is enhanced. This influence on the acid-base equilibrium is of importance not only for diabetes, but also for gastric and duodenal ulcer with reference to hyperacidity. The sequence of the action of sodium sulphate waters might therefore cover the following features: local removal of inflammatory lesions in the gastro-intestinal tube, stimulation of liver function, improvement of carbohydrate metabolism, and in connection with it, removal of marked degree of acetonuria and increasing the buffer capacity.

Tissue Culture and Its Application to Radiological Problems — Time and Intensity Factors in Dosage. S. F. Cox.

Brit. Jour. Rad. 4:111, (March) 1931.

The purpose of these studies was to determine what a specified dose of X-irradiation will produce on biologic structure—whether the same effect will follow when applied over a short period with a large intensity as when the same dose is applied

over a longer period. "The Bunsen-Roscoe law of photo-chemical action of radiation," the author points out, "states that the product of time and intensity produce a constant effect." How far this law is applicable to biological material is still a matter of dispute. The variation in results obtained in this connection by different workers is perhaps due, at least in part, to the diversity of material employed. Perhaps the most ideal field for experimentation with x-ray is the observation of the growth of cells *in vitro*. Cox therefore, made use of charred and sclerotic tissues from 7-9 day, fowl embryos, that were grown by the hanging drop method. His conclusions are as follows:

1. The time and intensity factors in x-ray dosage were studied by irradiating tissue cultures grown by the hanging-drop method.

2. For small doses (25 R, 50 R, and 75 R), it was found that over the range of time and intensity employed, doses of long duration and small intensity were less effective in checking the mitotic activity than short doses of strong intensity.

3. For large doses (3,000 R to 12,000 R), the survival of the cultures subsequent to irradiation was used to determine the efficacy of the dose. A 2:1 variation of intensity had no appreciable effect on the changes induced by 3,000 R, while the same variation of intensity caused a dose of 12,000 R to be considerably more destructive at a larger intensity than at a smaller one.

Die Ultraviolettherapie Des Kindlichen Ekzems. (Actinotherapy of infantile eczema). Kurt Huldshinsky.

Klinische Wochenschrift, 8:71 (January) 1929.

The combination of the ultraviolet and silver methods, the so-called "Uv-Ag-method" realizes three advantages in that

1.) the silver precipitates almost instantaneously in the solution and sticks to the painted portion of the skin,

2.) the effect of the ultraviolet rays is in itself increased, and the dosage can be regulated at will,

3.) deep action is prevented by the protective film of the silver salt on the affected area, although the surface effect is very pronounced and induces rapid new epithelialization.

Procedure in weeping eczema. The eczematous portion is painted with a 3 to 5 per cent solution of silver nitrate, the healthy portions are protected. The solution is allowed to dry on the skin or while still wet is irradiated, with a quartz mercury lamp at focal skin distances of from 50 to 15 cm. till blackening occurs. This is repeated one or more times during the period of radiation. This treatment requires from 1 to 5 minutes. Instead of the quartz mercury lamp, sunlight can be substituted. The irradiation time is naturally increased under the circumstances from 10 to 30 minutes. The effect of the "Uv-Ag-method" is an immediate one. The moist places dry up speedily, the previous reddish areas take on a black and glossy color, the itching subsides. The dry and black portions begin to exfoliate on the following day, healthy skin appears and the weeping places become coated and scab-like in texture. The part becomes smaller and is filled in with new granulating skin. Further

treatment is required in order to completely dry up the affected part. In the meantime indifferent or bland ointments are to be used.

More patience is required for the cure of the dry, chronic type of eczema that is associated with skin that is thick and hard. Here the treatments must be often repeated, approximately about 20 tanning and peeling of the skin. The stubborn cases have demonstrated the advantages of this new treatment over the ointment method. That the treatment is not foolproof against occasional recurrence in all cases is to be expected in the light of the endocrine character of the eczema.

Die Kontraindikationen Des Hoehenklimas. (Contraindications to mountain climate). R. Staehelin.

Therapie der Gegenwart. 70:97, (March) 1929.

Mountain climate is contraindicated for people subject to organic diseases of the heart, especially for those individuals with stasis phenomena, as well as for those with marked dyspnoea strain, and angina pectoris. If relatively small efforts lead to shortness of breath even on level land, the same will occur the more readily with much less muscular strain at higher altitudes. Staehelin especially warns against the use of carbonic acid baths at such heights because mountain climate has the same effect as carbonic acid baths. This action may be compared to a "lesson in gymnastics for heart and vessels." The application of both healing factors together is only to be tried in well compensated as well as in slight troubles of the myocardium.

Mountain climate is also contraindicated to arteriosclerosis, especially in more advanced cases; however, high mountain climate is not at all favorable even for arteriosclerosis. Nevertheless, if a patient with slight arteriosclerosis is longing to spend some weeks in the mountains it is permissible, only because opposition may often cause psychical damage greater than the physical effects of the high altitude. Of course, the cure must abruptly terminate even in lighter grade arteriosclerosis when acclimatization difficulties become manifest. Whether arteriosclerosis is associated with hyperpiesia or not, is, after all, of no consequence; strict individualization is always indicated. Hyperpiesia is only a contraindication, when even slight bodily exertions are sufficient to provoke an additional increase in an already high blood pressure.

A further contraindication is luetic affections of the aorta, heart valves, and coronary arteries. Angina pectoris, emphysema, and dry bronchitis are also contraindications. As regards tuberculosis of the lungs, cases beyond hope must not, of course, be sent to health resorts in high altitudes. Unsuitable cases are, on the whole, all patients with constant fever, dyspnoea and a constantly elevated pulse rate of more than 100, or a respiration of 120 beats.

The appearance of haemoptyses is no contraindication, provided the patient is not permitted to travel directly after such an emergency.

Anaemias are *per se* very excellent material for

high mountain climate. They are, however, contraindicated when the blood pressure is too low or the degeneration of the blood corpuscles is too rapid, as in pernicious anaemia.

Among the diseases of the nervous system, certain neuroses are a contraindication to mountain climate. There are patients whose nervous systems need rest, and not stimulation. These are erethistic, hypersensitive natures, on whom the smallest stimulus produces bodily and mental excitation. A cure in mountain climate should be chosen only in nervous affections associated with thyroid origin.

Cosmetic Rules for the Medical Praxis. Franz Blumenthal.

Therapie d. Gegenwart. 71:357, (August) 1930.

The most favorable cosmetic result to be desired after surgical procedure is a linear scar. It is better to avoid any method where the healing effect in the depth of tissue cannot be estimated. To these methods belong the alkaline or acid reactions which frequently cause formation of keloids. For the same reason some authors have abandoned thermocoagulation in favor of the electrolysis because the latter gives a possibility of measuring and thus predicting the final result. For this reason the author prefers electrolysis to epilation in hypertrichosis.

For the removal of superficial cosmetic defects desiccation is advocated. This can be done by the use of high frequency currents, using an especially fitted diathermy apparatus. The method gives excellent results in the removal of vastly expanded superficial processes such as xanthelasmas, pigmentations, warts, etc.

As to vascular naevi the best methods now in use for their destruction are irradiation and carbonic acid snow. The method to be used should be decided according to the case in question. The treatment with carbonic acid snow gives results in a short time, but is rather painful and the scars are very striking.

The ultraviolet lamp is an efficient instrument to produce compression of tissue. Furthermore, x-ray and radium may also be considered as valuable measures in treatment of scars. The treatment with ultraviolet rays is lengthy and troublesome, but the results are more uniform than those of carbonic acid snow. The latter is particularly suitable in the treatment of plain vascular naevi.

Many authors believe the treatment with radium-mesothorium,—and thorium X-preparations to be the method of choice. The advantages of radium and similar radiations are the painlessness and the relative quickness of effect, whereas thorium-X preparations can be used by any physician. The scars are even and soft and can be well fitted to the surroundings. The danger lies in the later damages; though the final results were improved by the filtering of the rays, damages cannot be totally avoided in spite of exact technic because the dose has to be selected strong enough to destroy the tissue of the neavus and this is relatively only slightly sensitive to radium. The effect of x-rays is the same as of radium, but less certain.

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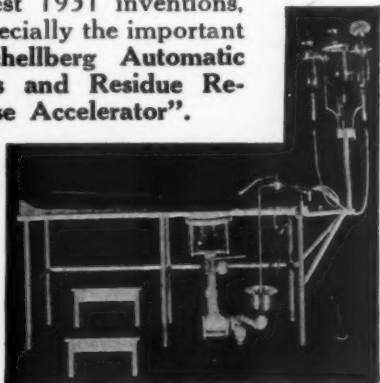
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